Karlsruher Institut für Technologie

# Module Handbook
# Mechanical Engineering (SPO 2016)

SPO 2016

Summer Term 2019

Date: 01.04.2019

KIT DEPARTMENT OF MECHANICAL ENGINEERING

# Table Of Contents

# 1 Field of study structure

| Mandatory | |
|---|---|
| Master Thesis | 30 CR |
| Advanced Engineering Fundamentals | 50 CR |
| Specialization | 40 CR |

## 1.1 Master Thesis

**Credits**
30

| Mandatory | | |
|---|---|---|
| M-MACH-102858 | Master's Thesis | 30 CR |

## 1.2 Advanced Engineering Fundamentals

**Credits**
50

| Mandatory | | |
|---|---|---|
| M-MACH-102593 | Product Development - Dimensioning of Components | 7 CR |
| M-MACH-102718 | Product Development - Methods of Product Development | 6 CR |
| M-MACH-102592 | Modeling and Simulation | 7 CR |
| M-MACH-102594 | Mathematical Methods | 6 CR |
| M-MACH-102591 | Laboratory Course | 4 CR |
| M-MACH-102597 | Compulsory Elective Module Mechanical Engineering | 8 CR |
| M-MACH-102595 | Compulsory Elective Module Natural Science/Computer Science/Electrical Engineering | 6 CR |
| M-MACH-102596 | Compulsory Elective Subject Economics/Law | 4 CR |
| M-MACH-102824 | Key Competences | 2 CR |

## 1.3 Specialization

Credits
40

| Election block: Vertiefungsrichtung (1 item) | |
|---|---|
| Specialization: General Mechanical Engineering | 40 CR |
| Specialization: Energy- and Environment Engineering | 40 CR |
| Specialization: Vehicle Technology | 40 CR |
| Specialization: Mechatronics and Microsystems Technology | 40 CR |
| Specialization: Product Development and Engineering Design | 40 CR |
| Specialization: Production Technology | 40 CR |
| Specialization: Theoretical Mechanical Engineering | 40 CR |
| Specialization: Materials and Structures for High Performance Systems | 40 CR |

### 1.3.1 Specialization: General Mechanical Engineering

**Part of: Specialization**

Credits
40

| Mandatory | | |
|---|---|---|
| M-MACH-102405 | Fundamentals and Methods of General Mechanical Engineering | 8 CR |
| **Election block: Schwerpunkte (2 items)** | | |
| M-MACH-102649 | Major Field: Advanced Materials Modelling | 16 CR |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102599 | Major Field: Powertrain Systems | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102641 | Major Field: Rail System Technology | 16 CR |
| M-MACH-102604 | Major Field: Computational Mechanics | 16 CR |
| M-MACH-102642 | Major Field: Development of Innovative Appliances and Power Tools | 16 CR |
| M-MACH-102605 | Major Field: Engineering Design | 16 CR |
| M-MACH-102606 | Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics | 16 CR |
| M-MACH-102643 | Major Field: Fusion Technology | 16 CR |
| M-MACH-102648 | Major Field: Energy Technology for Buildings | 16 CR |
| M-MACH-102623 | Major Field: Fundamentals of Energy Technology | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102625 | Major Field: Information Technology of Logistic Systems | 16 CR |
| M-MACH-102626 | Major Field: Integrated Product Development | 16 CR |
| M-MACH-102608 | Major Field: Nuclear Energy | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102607 | Major Field: Vehicle Technology | 16 CR |
| M-MACH-102627 | Major Field: Energy Converting Engines | 16 CR |
| M-MACH-102610 | Major Field: Power Plant Technology | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102613 | Major Field: Lifecycle Engineering | 16 CR |
| M-MACH-102629 | Major Field: Logistics and Material Flow Theory | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |
| M-MACH-102615 | Major Field: Medical Technology | 16 CR |
| M-MACH-102600 | Major Field: Man - Technology - Organisation | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-102630 | Major Field: Mobile Machines | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |

| | | |
|---|---|---|
| M-MACH-102612 | Major Field: Modeling and Simulation in Energy- and Fluid Engineering | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-102618 | Major Field: Production Technology | 16 CR |
| M-MACH-102633 | Major Field: Robotics | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102634 | Major Field: Fluid Mechanic | 16 CR |
| M-MACH-102619 | Major Field: Technical Ceramics and Powder Materials | 16 CR |
| M-MACH-102640 | Major Field: Technical Logistics | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102636 | Major Field: Thermal Turbomachines | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102650 | Major Field: Combustion Engines Based Powertrains | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.2 Specialization: Energy- and Environment Engineering

**Part of: Specialization**

**Credits** 40

| | | |
|---|---|---|
| **Mandatory** | | |
| M-MACH-102575 | Fundamentals and Methods of Energy and Environmental Engineering | 8 CR |
| M-MACH-102623 | Major Field: Fundamentals of Energy Technology | 16 CR |
| **Election block: Schwerpunkt (1 item)** | | |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102642 | Major Field: Development of Innovative Appliances and Power Tools | 16 CR |
| M-MACH-102605 | Major Field: Engineering Design | 16 CR |
| M-MACH-102643 | Major Field: Fusion Technology | 16 CR |
| M-MACH-102648 | Major Field: Energy Technology for Buildings | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-104323 | Major Field: Innovation and Entrepreneurship | 16 CR |
| M-MACH-102626 | Major Field: Integrated Product Development | 16 CR |
| M-MACH-102608 | Major Field: Nuclear Energy | 16 CR |
| M-MACH-102627 | Major Field: Energy Converting Engines | 16 CR |
| M-MACH-102610 | Major Field: Power Plant Technology | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |
| M-MACH-102600 | Major Field: Man - Technology - Organisation | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-102612 | Major Field: Modeling and Simulation in Energy- and Fluid Engineering | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102634 | Major Field: Fluid Mechanic | 16 CR |
| M-MACH-102619 | Major Field: Technical Ceramics and Powder Materials | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102636 | Major Field: Thermal Turbomachines | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102650 | Major Field: Combustion Engines Based Powertrains | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.3 Specialization: Vehicle Technology

**Part of: Specialization**

**Credits**
40

| **Mandatory** | | |
|---|---|---|
| M-MACH-102739 | Fundamentals and Methods of Automotive Engineering | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102641 | Major Field: Rail System Technology | 16 CR |
| M-MACH-102607 | Major Field: Vehicle Technology | 16 CR |
| M-MACH-102630 | Major Field: Mobile Machines | 16 CR |
| M-MACH-102650 | Major Field: Combustion Engines Based Powertrains | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102599 | Major Field: Powertrain Systems | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102604 | Major Field: Computational Mechanics | 16 CR |
| M-MACH-102642 | Major Field: Development of Innovative Appliances and Power Tools | 16 CR |
| M-MACH-102605 | Major Field: Engineering Design | 16 CR |
| M-MACH-102606 | Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics | 16 CR |
| M-MACH-102623 | Major Field: Fundamentals of Energy Technology | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102626 | Major Field: Integrated Product Development | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102627 | Major Field: Energy Converting Engines | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102613 | Major Field: Lifecycle Engineering | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-102612 | Major Field: Modeling and Simulation in Energy- and Fluid Engineering | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-102618 | Major Field: Production Technology | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102634 | Major Field: Fluid Mechanic | 16 CR |
| M-MACH-102619 | Major Field: Technical Ceramics and Powder Materials | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102636 | Major Field: Thermal Turbomachines | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.4 Specialization: Mechatronics and Microsystems Technology

**Part of: Specialization**

**Credits**
40

| **Mandatory** | | |
|---|---|---|
| M-MACH-102740 | Fundamentals and Methods of Mechatronics and Microsystem Technology | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |

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| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-102633 | Major Field: Robotics | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102641 | Major Field: Rail System Technology | 16 CR |
| M-MACH-102604 | Major Field: Computational Mechanics | 16 CR |
| M-MACH-102606 | Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics | 16 CR |
| M-MACH-102623 | Major Field: Fundamentals of Energy Technology | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102613 | Major Field: Lifecycle Engineering | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102615 | Major Field: Medical Technology | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102630 | Major Field: Mobile Machines | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-102612 | Major Field: Modeling and Simulation in Energy- and Fluid Engineering | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102650 | Major Field: Combustion Engines Based Powertrains | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.5 Specialization: Product Development and Engineering Design

**Part of: Specialization**

**Credits** 40

| | | |
|---|---|---|
| **Mandatory** | | |
| M-MACH-102741 | Fundamentals and Methods of Product Development and Construction | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102642 | Major Field: Development of Innovative Appliances and Power Tools | 16 CR |
| M-MACH-102626 | Major Field: Integrated Product Development | 16 CR |
| M-MACH-102613 | Major Field: Lifecycle Engineering | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102599 | Major Field: Powertrain Systems | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102641 | Major Field: Rail System Technology | 16 CR |
| M-MACH-102604 | Major Field: Computational Mechanics | 16 CR |
| M-MACH-102605 | Major Field: Engineering Design | 16 CR |
| M-MACH-102606 | Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics | 16 CR |
| M-MACH-102623 | Major Field: Fundamentals of Energy Technology | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102625 | Major Field: Information Technology of Logistic Systems | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102607 | Major Field: Vehicle Technology | 16 CR |
| M-MACH-102627 | Major Field: Energy Converting Engines | 16 CR |
| M-MACH-102610 | Major Field: Power Plant Technology | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102629 | Major Field: Logistics and Material Flow Theory | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |

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|---|---|---|
| M-MACH-102615 | Major Field: Medical Technology | 16 CR |
| M-MACH-102600 | Major Field: Man - Technology - Organisation | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-102630 | Major Field: Mobile Machines | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-102612 | Major Field: Modeling and Simulation in Energy- and Fluid Engineering | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-102618 | Major Field: Production Technology | 16 CR |
| M-MACH-102633 | Major Field: Robotics | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102634 | Major Field: Fluid Mechanic | 16 CR |
| M-MACH-102619 | Major Field: Technical Ceramics and Powder Materials | 16 CR |
| M-MACH-102640 | Major Field: Technical Logistics | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102650 | Major Field: Combustion Engines Based Powertrains | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.6 Specialization: Production Technology

**Part of: Specialization**

**Credits**
40

| | | |
|---|---|---|
| **Mandatory** | | |
| M-MACH-102742 | Fundamentals and Methods of Production Technology | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102613 | Major Field: Lifecycle Engineering | 16 CR |
| M-MACH-102629 | Major Field: Logistics and Material Flow Theory | 16 CR |
| M-MACH-102600 | Major Field: Man - Technology - Organisation | 16 CR |
| M-MACH-102618 | Major Field: Production Technology | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102599 | Major Field: Powertrain Systems | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102642 | Major Field: Development of Innovative Appliances and Power Tools | 16 CR |
| M-MACH-102605 | Major Field: Engineering Design | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102625 | Major Field: Information Technology of Logistic Systems | 16 CR |
| M-MACH-102626 | Major Field: Integrated Product Development | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |
| M-MACH-102647 | Major Field: Microactuators and Microsensors | 16 CR |
| M-MACH-102616 | Major Field: Microsystem Technology | 16 CR |
| M-MACH-102630 | Major Field: Mobile Machines | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-102633 | Major Field: Robotics | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102640 | Major Field: Technical Logistics | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |

| | | |
|---|---|---|
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.7 Specialization: Theoretical Mechanical Engineering

**Part of: Specialization**

**Credits** 40

| | | |
|---|---|---|
| **Mandatory** | | |
| M-MACH-102743 | Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102604 | Major Field: Computational Mechanics | 16 CR |
| M-MACH-104434 | Major Field: Modeling and Simulation in Dynamics | 16 CR |
| M-MACH-104443 | Major Field: Vibration Theory | 16 CR |
| M-MACH-102634 | Major Field: Fluid Mechanic | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102649 | Major Field: Advanced Materials Modelling | 16 CR |
| M-MACH-102598 | Major Field: Advanced Mechatronics | 16 CR |
| M-MACH-102601 | Major Field: Automation Technology | 16 CR |
| M-MACH-102606 | Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics | 16 CR |
| M-MACH-102643 | Major Field: Fusion Technology | 16 CR |
| M-MACH-102624 | Major Field: Information Technology | 16 CR |
| M-MACH-102608 | Major Field: Nuclear Energy | 16 CR |
| M-MACH-102609 | Major Field: Cognitive Technical Systems | 16 CR |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102614 | Major Field: Mechatronics | 16 CR |
| M-MACH-102633 | Major Field: Robotics | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102636 | Major Field: Thermal Turbomachines | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |

### 1.3.8 Specialization: Materials and Structures for High Performance Systems

**Part of: Specialization**

**Credits** 40

| | | |
|---|---|---|
| **Mandatory** | | |
| M-MACH-102744 | Fundamentals and Methods of Materials and Structures for High Performance Systems | 8 CR |
| **Election block: Schwerpunkt (p) (between 1 and 2 items)** | | |
| M-MACH-102611 | Major Field: Materials Science and Engineering | 16 CR |
| M-MACH-102602 | Major Field: Reliability in Mechanical Engineering | 16 CR |
| **Election block: Schwerpunkt (between 0 and 1 items)** | | |
| M-MACH-102649 | Major Field: Advanced Materials Modelling | 16 CR |
| M-MACH-102646 | Major Field: Applied Mechanics | 16 CR |
| M-MACH-102628 | Major Field: Lightweight Construction | 16 CR |
| M-MACH-102632 | Major Field: Polymer Engineering | 16 CR |
| M-MACH-102619 | Major Field: Technical Ceramics and Powder Materials | 16 CR |
| M-MACH-102635 | Major Field: Engineering Thermodynamics | 16 CR |
| M-MACH-102636 | Major Field: Thermal Turbomachines | 16 CR |
| M-MACH-102637 | Major Field: Tribology | 16 CR |

# 2 Modules

## M 2.1 Module: Compulsory Elective Module Mechanical Engineering (MSc-Modul 04, WF) [M-MACH-102597]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 8 | Once | Deutsch/Englisch | 4 | 1 |

| Election block: Wahlpflichtmodul Maschinenbau (2 items) | | | |
|---|---|---|---|
| T-MACH-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | 4 CR | Gohl |
| T-MACH-105528 | Aerodynamics | 4 CR | Frohnapfel, Ohle |
| T-MACH-105437 | Aerothermodynamics | 4 CR | Frohnapfel, Seiler |
| T-MACH-105238 | Actuators and Sensors in Nanotechnology | 4 CR | Kohl |
| T-MACH-105215 | Applied Tribology in Industrial Product Development | 4 CR | Albers, Lorentz |
| T-MACH-105527 | Applied Materials Modelling | 7 CR | Gumbsch, Schulz |
| T-MACH-105307 | Drive Train of Mobile Machines | 4 CR | Geimer, Wydra |
| T-MACH-105390 | Application of Advanced Programming Languages in Mechanical Engineering | 4 CR | Weygand |
| T-MACH-105649 | Boosting of Combustion Engines | 4 CR | Kech |
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105519 | Human Factors Engineering II | 4 CR | Deml |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-102141 | Constitution and Properties of Wearresistant Materials | 4 CR | Ulrich |
| T-MACH-105150 | Constitution and Properties of Protective Coatings | 4 CR | Ulrich |
| T-MACH-105381 | Virtual Engineering (Specific Topics) | 4 CR | Ovtcharova |
| T-MACH-102160 | Selected Applications of Technical Logistics | 4 CR | Milushev, Mittwollen |
| T-MACH-105428 | Selected Chapters of the Combustion Fundamentals | 4 CR | Maas |
| T-MACH-105462 | Selected Problems of Applied Reactor Physics and Exercises | 4 CR | Dagan |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105311 | Design and Development of Mobile Machines | 4 CR | Geimer, Siebert |
| T-MACH-105536 | Dimensioning and Optimization of Power Train System | 4 CR | Faust, Kirchner |
| T-MACH-105217 | Automation Systems | 4 CR | Kaufmann |
| T-MACH-106424 | Rail System Technology | 4 CR | Gratzfeld |
| T-MACH-105184 | Fuels and Lubricants for Combustion Engines | 4 CR | Kehrwald, Kubach |
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |
| T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 4 CR | Guber |
| T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 4 CR | Guber |
| T-MACH-106877 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine IV | 4 CR | Guber |
| T-MACH-102172 | Bionics for Engineers and Natural Scientists | 4 CR | Hölscher |
| T-MACH-102150 | BUS-Controls | 4 CR | Becker, Geimer |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105407 | CFD in Power Engineering | 4 CR | Otic |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |

| | | | |
|---|---|---|---|
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-108719 | Designing with numerical methods in product development | 4 CR | Schnack |
| T-MACH-105540 | Railways in the Transportation Market | 4 CR | Gratzfeld |
| T-MACH-108721 | Designing with Composites | 4 CR | Schnack |
| T-MACH-105391 | Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems | 4 CR | Günther |
| T-MACH-108460 | Digital microstructure characterization and modeling | 6 CR | Schneider |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| T-MACH-105320 | Introduction to the Finite Element Method | 5 CR | Böhlke, Langhoff |
| T-MACH-108718 | Introduction to numerical mechanics | 4 CR | Schnack |
| T-MACH-105525 | Introduction to Nuclear Energy | 4 CR | Cheng |
| T-MACH-105321 | Introduction to Theory of Materials | 4 CR | Kamlah |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-105439 | Introduction to Nonlinear Vibrations | 7 CR | Fidlin |
| T-MACH-102121 | Electric Rail Vehicles | 4 CR | Gratzfeld |
| T-MACH-102159 | Elements and Systems of Technical Logistics | 4 CR | Fischer, Mittwollen |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-105952 | Energy Storage and Network Integration | 4 CR | Jäger, Stieglitz |
| T-MACH-105408 | Energy Systems I: Renewable Energy | 6 CR | Dagan |
| T-MACH-105984 | Fatigue of Welded Components and Structures | 3 CR | Farajian, Gumbsch |
| T-MACH-105228 | Organ Support Systems | 4 CR | Pylatiuk |
| T-MACH-105512 | Experimental Fluid Mechanics | 4 CR | Kriegseis |
| T-MACH-106373 | Experimental techniques in thermo- and fluid-dynamics | 4 CR | Cheng |
| T-MACH-105152 | Handling Characteristics of Motor Vehicles I | 4 CR | Unrau |
| T-MACH-105153 | Handling Characteristics of Motor Vehicles II | 4 CR | Unrau |
| T-MACH-105154 | Vehicle Comfort and Acoustics I | 4 CR | Gauterin |
| T-MACH-105155 | Vehicle Comfort and Acoustics II | 4 CR | Gauterin |
| T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | 4 CR | Henning |
| T-MACH-105156 | Vehicle Mechatronics I | 4 CR | Ammon |
| T-MACH-107667 | Solid State Reactions and Kinetics of Phase | 6 CR | Franke, Seifert |
| T-MACH-102207 | Tires and Wheel Development for Passenger Cars | 4 CR | Leister |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 4 CR | Henning |
| T-MACH-102166 | Fabrication Processes in Microsystem Technology | 4 CR | Bade |
| T-MACH-105394 | Finite Volume Methods for Fluid Flow | 4 CR | Günther |
| T-MACH-105474 | Fluid-Structure-Interaction | 4 CR | Frohnapfel, Mühlhausen |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-105411 | Fusion Technology A | 4 CR | Stieglitz |
| T-MACH-105433 | Fusion Technology B | 4 CR | Stieglitz |
| T-MACH-105444 | Combined Cycle Power Plants | 4 CR | Schulenberg |
| T-MACH-108848 | Global Production and Logistics - Part 1: Global Production | 4 CR | Lanza |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105467 | Microstructure Characteristics Relationships | 6 CR | Gruber, Kraft |
| T-MACH-105157 | Foundry Technology | 4 CR | Wilhelm |
| T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics | 4 CR | Furmans |
| T-MACH-102117 | Automotive Engineering II | 4 CR | Gauterin, Unrau |
| T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR | Schell |

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| T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | 4 CR | Deutschmann, Grunwaldt, Kubach, Lox |
| T-MACH-105235 | Principles of Medicine for Engineers | 4 CR | Pylatiuk |
| 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-105324 | Foundations of Nonlinear Continuum Mechanics | 4 CR | Kamlah |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105325 | Fundamentals of Combustion II | 4 CR | Maas |
| T-MACH-105424 | Optical Flow Measurement: Fundamentals and Applications | 4 CR | Frohnapfel, Seiler |
| T-MACH-106746 | Hands-on BioMEMS | 4 CR | Guber |
| T-MACH-105398 | High Performance Computing | 5 CR | Nestler, Selzer |
| T-MACH-105459 | High Temperature Materials | 4 CR | Heilmaier |
| T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | 4 CR | Stock |
| T-MACH-105425 | Hydrodynamic Stability: From Order to Chaos | 4 CR | Class |
| T-MACH-105375 | Industrial Aerodynamics | 4 CR | Breitling, Frohnapfel |
| T-MACH-105388 | Introduction to Industrial Production Economics | 4 CR | Dürrschnabel |
| T-MACH-105386 | Occupational Safety and Environmental Protection | 4 CR | von Kiparski |
| T-MACH-105404 | Innovative Nuclear Systems | 4 CR | Cheng |
| T-MACH-105466 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | 4 CR | Dagan |
| T-MACH-100287 | Introduction to Ceramics | 6 CR | Hoffmann |
| T-MACH-102182 | Ceramic Processing Technology | 4 CR | Binder |
| T-MACH-105402 | Nuclear Power Plant Technology | 4 CR | Badea, Cheng, Schulenberg |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-100293 | Structural Materials | 6 CR | Lang |
| T-MACH-105410 | Coal Fired Power Plants | 4 CR | Schulenberg |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105786 | Contact Mechanics | 4 CR | Greiner |
| T-MACH-105414 | Cooling of Thermally High Loaded Gas Turbine Components | 4 CR | Bauer, Schulz |
| T-MACH-105164 | Laser in Automotive Engineering | 4 CR | Schneider |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-102089 | Logistics - Organisation, Design and Control of Logistic Systems | 6 CR | Furmans |
| T-MACH-105165 | Automotive Logistics | 4 CR | Furmans |
| T-MACH-105426 | Magnetohydrodynamics | 4 CR | Bühler |
| T-MACH-105434 | Magnet Technology of Fusion Reactors | 4 CR | Fietz, Weiss |
| T-MACH-105440 | Leadership and Conflict Management | 4 CR | Hatzl |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-105166 | Materials and Processes for Body Leightweight Construction in the Automotive Industry | 4 CR | Kienzle, Steegmüller |
| T-MACH-108957 | Mathematical Fundamentals of Numerical Mechanics | 4 CR | Schnack |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105419 | Mathematical Models and Methods in Combustion Theory | 4 CR | Bykov, Maas |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-108717 | Mechanics of Laminated Composites | 4 CR | Schnack |
| T-MACH-105333 | Mechanics and Strength of Polymers | 4 CR | von Bernstorff |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-105468 | Metals | 6 CR | Heilmaier |

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| T-MACH-105167 | Analysis Tools for Combustion Diagnostics | 4 CR | Pfeil |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-101910 | Microactuators | 4 CR | Kohl |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-102199 | Model Based Application Methods | 4 CR | Kirschbaum |
| T-MACH-105396 | Modeling of Thermodynamical Processes | 6 CR | Maas, Schießl |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MACH-105169 | Engine Measurement Techniques | 4 CR | Bernhardt |
| T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | 4 CR | Dienwiebel, Hölscher, Walheim |
| T-MACH-102167 | Nanotribology and -Mechanics | 4 CR | Dienwiebel, Hölscher |
| T-MACH-106747 | Neurovascular Interventions (BioMEMS V) | 4 CR | Cattaneo, Guber |
| T-MACH-105435 | Neutron Physics of Fusion Reactors | 4 CR | Fischer |
| T-MACH-105532 | Nonlinear Continuum Mechanics | 5 CR | Böhlke |
| T-MACH-108720 | Numerical Mechanics for Industrial Applications | 4 CR | Schnack |
| T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | 4 CR | Wörner |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105397 | Numerical Simulation of Turbulent Flows | 4 CR | Grötzbach |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-105387 | Planning of Assembly Systems | 4 CR | Haller |
| T-MACH-105516 | Multi-Scale Plasticity | 4 CR | Greiner, Schulz |
| T-MACH-102181 | PLM for Product Development in Mechatronics | 4 CR | Eigner |
| T-MACH-105340 | PLM in the Manufacturing Industry | 4 CR | Ovtcharova |
| T-MACH-102137 | Polymer Engineering I | 4 CR | Elsner |
| T-MACH-102138 | Polymer Engineering II | 4 CR | Elsner |
| T-MACH-102192 | Polymers in MEMS A: Chemistry, Synthesis and Applications | 4 CR | Rapp |
| T-MACH-102191 | Polymers in MEMS B: Physics, Microstructuring and Applications | 4 CR | Worgull |
| T-MACH-102200 | Polymers in MEMS C: Biopolymers and Bioplastics | 4 CR | Rapp, Worgull |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-102155 | Product, Process and Resource Integration in the Automotive Industry | 4 CR | Ovtcharova |
| T-MACH-105470 | Production Planning and Control | 4 CR | Rinn |
| T-MACH-105523 | Productivity Management in Production Systems | 4 CR | Stowasser |
| T-MACH-102156 | Project Workshop: Automotive Engineering | 6 CR | Frey, Gauterin, Gießler |
| T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | 5 CR | Schulze |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-104599 | Project Management in Rail Industry | 4 CR | Gratzfeld |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-105348 | Process Simulation in Forming Operations | 4 CR | Helm |
| T-MACH-102157 | High Performance Powder Metallurgy Materials | 4 CR | Oberacker |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105405 | Reactor Safety I: Fundamentals | 4 CR | Sanchez-Espinoza |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-105384 | Computerized Multibody Dynamics | 4 CR | Seemann |
| T-MACH-105351 | Computational Mechanics I | 6 CR | Böhlke, Langhoff |
| T-MACH-105352 | Computational Mechanics II | 6 CR | Böhlke, Langhoff |
| T-MACH-105421 | Reduction Methods for the Modeling and the Simulation of Vombustion Processes | 4 CR | Bykov, Maas |

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| T-MACH-109122 | X-ray Optics | 4 CR | Last |
| T-MACH-105724 | Failure Analysis | 4 CR | Greiner, Schneider |
| T-MACH-105353 | Rail Vehicle Technology | 4 CR | Gratzfeld |
| T-MACH-105354 | Fatigue of Metallic Materials | 4 CR | Lang |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105172 | Simulation of Coupled Systems | 4 CR | Geimer, Xiang |
| T-MACH-105400 | Scaling in Fluid Dynamics | 4 CR | Bühler |
| T-MACH-106493 | Solar Thermal Energy Systems | 4 CR | Dagan |
| T-MACH-105372 | Theory of Stability | 6 CR | Fidlin |
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105696 | Strategic product development - identification of potentials of innovative products | 4 CR | Siebe |
| T-MACH-105422 | Flows with Chemical Reactions | 4 CR | Class |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| T-MACH-102170 | Structural and Phase Analysis | 4 CR | Wagner |
| T-MACH-102179 | Structural Ceramics | 4 CR | Hoffmann |
| T-MACH-102103 | Superhard Thin Film Materials | 4 CR | Ulrich |
| T-MACH-105181 | Supply Chain Management | 6 CR | Alicke |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105360 | Computer Engineering | 6 CR | Keller, Lorch |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105361 | Technical Design in Product Development | 4 CR | Schmid |
| T-MACH-105362 | Technology of Steel Components | 4 CR | Schulze |
| T-MACH-105456 | Ten Lectures on Turbulence | 4 CR | Otic |
| T-MACH-105225 | Thermal Solar Energy | 4 CR | Stieglitz |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-105364 | Thermal Turbomachines II | 6 CR | Bauer |
| T-MACH-107670 | Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | 6 CR | Franke, Seifert |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-105423 | Tractors | 4 CR | Becker, Geimer, Kremmer |
| T-MACH-105365 | Turbine and Compressor Design | 4 CR | Bauer |
| T-MACH-105366 | Turbo Jet Engines | 4 CR | Bauer |
| T-MACH-105177 | Metal Forming | 4 CR | Herlan |
| T-MACH-105429 | Combustion Diagnositics | 4 CR | Maas, Schießl |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | 4 CR | Gruber, Gumbsch |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| T-MACH-102148 | Gear Cutting Technology | 4 CR | Klaiber |
| T-MACH-102123 | Virtual Engineering I | 4 CR | Ovtcharova |
| T-MACH-102124 | Virtual Engineering II | 4 CR | Ovtcharova |
| T-MACH-105430 | Heatpumps | 4 CR | Maas, Wirbser |
| T-MACH-105529 | Heat Transfer in Nuclear Reactors | 4 CR | Cheng |
| T-MACH-105416 | Hydrogen Technologies | 4 CR | Jordan |
| T-MACH-105443 | Wave Propagation | 4 CR | Seemann |
| T-MACH-105211 | Materials of Lightweight Construction | 4 CR | Weidenmann |
| T-MACH-105369 | Materials Modelling: Dislocation Based Plasticy | 4 CR | Weygand |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| T-MACH-105985 | Ignition systems | 4 CR | Toedter |
| T-MACH-105406 | Two-Phase Flow and Heat Transfer | 4 CR | Schulenberg, Wörner |
| **Election block: Wahlpflichtmodul Maschinenbau (Ü) ()** | | | |
| T-MACH-107671 | Exercises for Applied Materials Simulation | 0 CR | Gumbsch, Schulz |

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| T-MACH-108887 | Design and Development of Mobile Machines - Advance | 0 CR | Geimer, Siebert |
| T-MACH-108889 | BUS-Controls - Advance | 0 CR | Daiß, Geimer |
| T-MACH-109304 | Excercises - Fatigue of Welded Components and Structures | 1 CR | Farajian, Gumbsch |
| T-MACH-107632 | Exercises for Solid State Reactions and Kinetics of Phase Transformations | 0 CR | Franke, Seifert |
| T-MACH-108888 | Simulation of Coupled Systems - Advance | 0 CR | Geimer, Xiang |
| T-MACH-107669 | Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | 0 CR | Seifert |

**Competence Certificate**
written or oral exam

**Competence Goal**
The elective course serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
none

**Content**
see chosen brick courses.

**Workload**
The work load is about 240 hours, corresponding to 8 credit points. The work load varies from lecture to lecture, for example a lecture consisting of 4 credit points includes 28 h of presence during the lecture and 92 h preparation and rework time at home, 120 hours in total.

**Learning type**
Lecture, Tutorial, Lab Course

## M 2.2 Module: Compulsory Elective Module Natural Science/Computer Science/ Electrical Engineering (MSc-Modul WPF-Modul NIE) [M-MACH-102595]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Level | Version |
|---|---|---|---|
| 6 | Once | 4 | 1 |

| Election block: Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik (1 item) | | | |
|---|---|---|---|
| T-MACH-108847 | Applied Mathematics in Natural Science: Flows with chemical reactions | 6 CR | Class |
| T-MACH-108845 | Magnetohydrodynamics | 6 CR | Bühler |
| T-ETIT-100694 | Methods of Signal Processing | 6 CR | Puente León |
| T-ETIT-101939 | Photovoltaics | 6 CR | Powalla |
| T-MACH-109084 | Physical Basics of Laser Technology | 6 CR | Schneider |
| T-ETIT-109313 | Signals and Systems | 6 CR | Puente León |
| T-MACH-108846 | Stability: from order to chaos | 6 CR | Class |
| T-MACH-105360 | Computer Engineering | 6 CR | Keller, Lorch |

**Competence Certificate**
The success is monitored within the framework of academic achievements, it can vary according to the individually choice. The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

**Competence Goal**
After completing the elective module "Wahlpflichtmodul" the attendants are able to extend their knowledge in the field of mechanical engineering in the disciplines natural sciences, electrical engineering or the informatics. The attendants are aware of example approaches and know specific methods and fundamentals of these fields. Thus, the attendants are able to solve interdisciplinary problems by applying this knowledge and to adopt specialist skills by themselves later.

**Prerequisites**
none

**Content**
Please refer to the description of the listed courses.

**Workload**
The work load is about 180 hours, corresponding to 6 credit points.

**Learning type**
Lecture
Exercise course (depending on the course)

## 2.3 Module: Compulsory Elective Subject Economics/Law (MSc-Modul WPF-Modul WR) [M-MACH-102596]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 4 | Once | Deutsch | 4 | 1 |

| Election block: Wahlpflichtmodul Wirtschaft/Recht (1 item) | | | |
|---|---|---|---|
| T-MACH-105519 | Human Factors Engineering II | 4 CR | Deml |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-105440 | Leadership and Conflict Management | 4 CR | Hatzl |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-INFO-101310 | Patent Law | 4 CR | Dreier |
| T-INFO-101963 | Public Law I - Basic Principles | 4 CR | Marsch |

**Competence Certificate**
The success is monitored within the framework of academic achievements, it can vary according to the individually choice. The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

**Competence Goal**
Students can enlarge their knowledge about law and economics which affect mechanical engineering self-determined. They are able to describe circumstances of the case considering law or economics and apply it to simple cases. Later on in work life, they are able to evaluate, if and which subject specific support is necessary.

**Prerequisites**
none

**Content**
see chosen subject

**Workload**
The work load is about 120 hours, corresponding to 4 credit points.

**Learning type**
Lectures and practices; self-study

# M 2.4 Module: Fundamentals and Methods of Automotive Engineering (MSc-WPfM-GuM-FzgT) [M-MACH-102739]

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

**Part of:** Specialization / Specialization: Vehicle Technology (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

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| **Election block: Grundlagen und Methoden der Fahrzeugtechnik (2 items)** | | | |
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-ETIT-100534 | Electrical Engineering for Business Engineers, Part II | 5 CR | Menesklou |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105652 | Fundamentals of Combustion Engine Technology | 5 CR | Bernhardt, Kubach, Pfeil, Toedter, Wagner |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MATH-109620 | Probability Theory and Statistics | 6 CR | Hug |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Grundlagen und Methoden der Fahrzeugtechnik (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Automotive Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
None

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise.

## 2.5 Module: Fundamentals and Methods of Energy and Environmental Engineering (MSc-WPfM-GuM-E+U) [M-MACH-102575]

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

**Part of:** Specialization / Specialization: Energy- and Environment Engineering (mandatory)

| Credits | Recurrence | Duration | Language | Level | Version |
|---|---|---|---|---|---|
| 8 | Once | 1 term | Deutsch/Englisch | 4 | 1 |

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|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| **Election block: Grundlagen und Methoden der Energie- und Umwelttechnik (1 item)** | | | |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105652 | Fundamentals of Combustion Engine Technology | 5 CR | Bernhardt, Kubach, Pfeil, Toedter, Wagner |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Energy and Environmental Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Module grade calculation**
weight according to CP

**Prerequisites**
none

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise

## M 2.6 Module: Fundamentals and Methods of General Mechanical Engineering (MSc-WPfM-GuM-MB) [M-MACH-102405]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Grundlagen und Methoden des Maschinenbaus (2 items)** | | | |
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| 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-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105652 | Fundamentals of Combustion Engine Technology | 5 CR | Bernhardt, Kubach, Pfeil, Toedter, Wagner |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Grundlagen und Methoden des Maschinenbaus (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of General Mechanical Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
None.

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise

## 2.7 Module: Fundamentals and Methods of Materials and Structures for High Performance Systems (MSc-WPfPM-W+S) [M-MACH-102744]

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

**Part of:** Specialization / Specialization: Materials and Structures for High Performance Systems (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| **Election block: Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme (1 item)** | | | |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Materials and Structures for High Performance Systems" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
See Studienplan

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise.

## M 2.8 Module: Fundamentals and Methods of Mechatronics and Microsystem Technology (MSc-WPfM-M+M) [M-MACH-102740]

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

**Part of:** Specialization / Specialization: Mechatronics and Microsystems Technology (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik, Pflicht (1 item)** | | | |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105182 | Introduction to Microsystem Technology I | 4 CR | Badilita, Jouda, Korvink |
| **Election block: Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik (1 item)** | | | |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| 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-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105652 | Fundamentals of Combustion Engine Technology | 5 CR | Bernhardt, Kubach, Pfeil, Toedter, Wagner |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MATH-109620 | Probability Theory and Statistics | 6 CR | Hug |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| **Election block: Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Mechatronics and Microsystem Technology" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
None

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise

## M 2.9 Module: Fundamentals and Methods of Product Development and Construction (MSc-WPfM-GuM-PEK) [M-MACH-102741]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: Product Development and Engineering Design (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Grundlagen und Methoden der Produktentwicklung und Konstruktion (2 items)** | | | |
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| 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-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105652 | Fundamentals of Combustion Engine Technology | 5 CR | Bernhardt, Kubach, Pfeil, Toedter, Wagner |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| **Election block: Grundlagen und Methoden der Produktentwicklung und Konstruktion (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Product Development and Construction" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical Engineering.

**Prerequisites**
None

**Content**
See courses.

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lecture, exercise.

# M 2.10 Module: Fundamentals and Methods of Production Technology (MSc-WPf-GuM-PT) [M-MACH-102742]

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

**Part of:** Specialization / Specialization: Production Technology (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Grundlagen und Methoden der Produktionstechnik (2 items)** | | | |
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| 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-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-102102 | Physical Basics of Laser Technology | 5 CR | Schneider |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-102083 | Integrated Information Systems for Engineers | 4 CR | Ovtcharova |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| **Election block: Grundlagen und Methoden der Produktionstechnik (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |

**Competence Certificate**
2 exams:

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**
"Fundamentals and Methods of Production Technology" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering

**Prerequisites**
none

**Content**
Fundamentals and Methods of Production Technology

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

**Learning type**
Lectures, seminars, workshops, excursions

## M 2.11 Module: Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering (MSc-WPfM-GuM-ThM) [M-MACH-102743]

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

**Part of:** Specialization / Specialization: Theoretical Mechanical Engineering (mandatory)

| Credits | Language | Level | Version |
|---|---|---|---|
| 8 | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Grundlagen und Methoden des Theoretischen Maschinenbaus (2 items)** | | | |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-100300 | Modelling and Simulation | 5 CR | Gumbsch, Nestler |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-100530 | Physics for Engineers | 5 CR | Dienwiebel, Gumbsch, Nesterov-Müller, Weygand |
| T-MACH-100531 | Systematic Materials Selection | 4 CR | Dietrich |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MATH-109620 | Probability Theory and Statistics | 6 CR | Hug |
| T-MACH-105292 | Heat and Mass Transfer | 4 CR | Bockhorn, Maas |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Grundlagen und Methoden des Theoretischen Maschinenbaus (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
2 individual exams: written or oral, graded

**Competence Goal**
"Fundamentals and Methods of Theoretical Foundations of Mechanical Engineering" serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering.

**Prerequisites**
None

**Content**
see chosen course

**Workload**
The work load is about 240 hours, corresponding to 8 credit points.

# M 2.12 Module: Key Competences [M-MACH-102824]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Duration | Level | Version |
|---|---|---|---|---|
| 2 | Once | 2 term | 4 | 2 |

| Election block: Schlüssselqualifikationen (1 item) | | | |
|---|---|---|---|
| T-MACH-105721 | Engineer's Field of Work | 2 CR | Doppelbauer, Gratzfeld |
| T-MACH-106375 | Value stream within enterprises – The value chain at Bosch | 2 CR | Maier |
| T-MACH-106700 | Do it! – Service-Learning for prospective mechanical engineers | 2 CR | Deml |
| T-MACH-106377 | HoC lectures | 2 CR | Heilmaier |
| T-MACH-106376 | ZAK lectures | 2 CR | Heilmaier |

**Competence Certificate**
Success is monitored within the framework of academic achievements.

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

**Competence Goal**
After completing the module Key Competences students can

- determine and coordinate work steps, projects and goals, proceed systematically and purposefully, set priorities as well as assess the feasibility of a task,
- apply methods for the planning of a specific task under given framework conditions in a goal- and resource-oriented way,
- describe methods for scientific research and selection of technical information according to pre-established quality criteria and apply them to given problems,
- discuss empirical methods and apply them to selected examples,
- present technical information in a clear, readable, and convincingly argued manner in various forms of presentation (e.g. poster, exposé, abstract) in writing and appropriately visualize it graphically (e.g. engineering drawings, flowcharts),
- present and stand up for technical content in a convincing and appealing way,
- work as a team in a task-oriented manner, handle any conflicts on their own and take responsibility for themselves and others,
- communicate as a team in an objective, goal-oriented and interpersonal manner, represent their own interests, reflect and take into account the interests of others in their own words, and successfully organize the course of the conversation.

**Module grade calculation**
Certification without note

**Prerequisites**
none

**Content**
The module Key Competences consists of freely selectable courses offered by the KIT-House of Competence (HoC), the KIT Language Centre (SPZ) and the Centre for Cultural and General Studies (ZAK) with a work load corresponding to a total of at least 2 ECTS. Upon request, the examination board may approve further courses as freely selectable subjects in the module "Key Competences".

**Annotation**
Only HoC/SPZ/ZAK courses can be chosen.

**Workload**
The work load is about 60 hours, corresponding to 2 credit points in the Master of Science program.

**Learning type**
The teaching and learning methods depend on the respectively chosen courses. The courses can be lectures, seminars, tutorials, or lab courses.

# M 2.13 Module: Laboratory Course (MSc-Modul 07, FP) [M-MACH-102591]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 4 | Once | Deutsch/Englisch | 4 | 1 |

| Election block: Laborpraktikum (1 item) | | | |
|---|---|---|---|
| T-MACH-105230 | Decentrally Controlled Intralogistic Systems | 4 CR | Furmans, Hochstein |
| T-MACH-105447 | Metallographic Lab Class | 4 CR | Hauf |
| T-MACH-105331 | Laboratory Exercise in Energy Technology | 4 CR | Bauer, Maas, Wirbser |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| T-MACH-105300 | Measurement Instrumentation Lab | 4 CR | Spindler, Stiller |
| T-MACH-105337 | Engine Laboratory | 4 CR | Wagner |
| T-MACH-106693 | Plug-and-play material handling | 4 CR | Dziedzitz, Furmans |
| T-MACH-106707 | Workshop on computer-based flow measurement techniques | 4 CR | Bauer |
| T-MACH-102154 | Laboratory Laser Materials Processing | 4 CR | Schneider |
| T-MACH-105343 | Lab Course Experimental Solid Mechanics | 4 CR | Böhlke |
| T-MACH-105346 | Production Techniques Laboratory | 4 CR | Deml, Fleischer, Furmans, Ovtcharova |
| T-MACH-106738 | ProVIL - Product development in a Virtual Idea Laboratory | 4 CR | Albers |
| T-MACH-105373 | Practical Training in Measurement of Vibrations | 4 CR | Fidlin |
| T-MACH-108312 | Introduction to Microsystem Technology - Practical Course | 4 CR | Last |
| T-MACH-108796 | Flow Measurement Techniques | 4 CR | Kriegseis |

**Competence Certificate**
The success is monitored within the framework of academic achievements, it can vary according to the individually choice. The module is not graded, and remains not graded even after the choice of one or several graded brick courses.

**Competence Goal**
Students are able to:

- Model typical problems in the laboratory and use typical methods of mecanical science to inquire,
- Built experiment designs, while choosing appropriate system components and models,
- Accomplish experiments goal-oriented,
- Analyse and evaluate results of experiments.

**Prerequisites**
none

**Content**
see chosen practical training

**Workload**
The work load is about 120 hours, corresponding to 4 credit points.

**Learning type**
practical training, self-study

## M 2.14 Module: Major Field: Advanced Materials Modelling (SP 56) [M-MACH-102649]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-105532 | Nonlinear Continuum Mechanics | 5 CR | Böhlke |
| **Election block: Advanced Materials Modelling (E) ()** | | | |
| T-MACH-105459 | High Temperature Materials | 4 CR | Heilmaier |
| T-MACH-105554 | Thin Film and Small-scale Mechanical Behavior | 4 CR | Gruber, Schwaiger, Weygand |

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

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

**Competence Goal**
The student can

- describe the physical foundation of particle based simulation method (e.g. molecular dynamics)

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.15 Module: Major Field: Advanced Mechatronics (SP 01) [M-MACH-102598]

**Responsible:** PD Dr.-Ing. Markus Reischl
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of each Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Advanced Mechatronics (K) (at least 8 credits)** | | | |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-105384 | Computerized Multibody Dynamics | 4 CR | Seemann |
| T-MACH-105443 | Wave Propagation | 4 CR | Seemann |
| **Election block: Advanced Mechatronics (E) (at most 8 credits)** | | | |
| T-MACH-105238 | Actuators and Sensors in Nanotechnology | 4 CR | Kohl |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |
| T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 4 CR | Guber |
| T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 4 CR | Guber |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-105156 | Vehicle Mechatronics I | 4 CR | Ammon |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105328 | Information Processing in Mechatronic Systems | 4 CR | Kaufmann |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-105378 | Cognitive Automobiles - Laboratory | 6 CR | Kitt, Lauer, Stiller |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105223 | Machine Vision | 8 CR | Lauer, Stiller |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-INFO-101266 | Human-Machine-Interaction | 6 CR | Beigl |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | 4 CR | Gengenbach, Hagenmeyer, Koker, Sieber |
| T-MACH-101910 | Microactuators | 4 CR | Kohl |

| | | | |
|---|---|---|---|
| T-MACH-105539 | Modern Control Concepts I | 4 CR | Groell, Matthes |
| T-MACH-106691 | Modern Control Concepts II | 4 CR | Groell |
| T-MACH-106692 | Modern Control Concepts III | 4 CR | Groell |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-ETIT-109313 | Signals and Systems | 6 CR | Puente León |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| T-MACH-105985 | Ignition systems | 4 CR | Toedter |
| **Election block: Advanced Mechatronics (P) (at most 4 credits)** | | | |
| T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | 4 CR | Stiller |
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |
| **Election block: Advanced Mechatronics (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-INFO-106257 | Human-Machine-Interaction | 0 CR | Beigl |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Students of the major Advanced Mechatronics know the future-oriented procedures. They are able to creatively solve complex interdisciplinary questions, in particular by applying the latest computer-assisted mathematical methods.

**Prerequisites**
None

**Content**
The Advanced Mechatronics offers a broad, multidisciplinary body of knowledge. It qualifies graduates to solve essential mechatronic questions. In particular the following disciplines are covered by the major Advanced Mechatronics:

- Control theory
- measurement technology and signal processing,
- modelling and
- mathematical methods.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
The contents of this major field are taught in form of lectures, exercises and practical experiences.

# M 2.16 Module: Major Field: Applied Mechanics (SP 30) [M-MACH-102646]

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

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt (p))
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Angewandte Mechanik (K) (at least 8 credits)** | | | |
| T-MACH-105351 | Computational Mechanics I | 6 CR | Böhlke, Langhoff |
| T-MACH-105352 | Computational Mechanics II | 6 CR | Böhlke, Langhoff |
| **Election block: Angewandte Mechanik (E) (at most 8 credits)** | | | |
| T-MACH-109302 | Computational Homogenization on Digital Image Data | 6 CR | Schneider |
| T-MACH-105321 | Introduction to Theory of Materials | 4 CR | Kamlah |
| T-MACH-105439 | Introduction to Nonlinear Vibrations | 7 CR | Fidlin |
| T-MACH-105324 | Foundations of Nonlinear Continuum Mechanics | 4 CR | Kamlah |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-105532 | Nonlinear Continuum Mechanics | 5 CR | Böhlke |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MACH-105348 | Process Simulation in Forming Operations | 4 CR | Helm |
| T-MACH-105349 | Computational Dynamics | 4 CR | Proppe |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-105971 | Simulation of the process chain of continuously fiber reinforced composite structure | 4 CR | Kärger |
| T-MACH-105372 | Theory of Stability | 6 CR | Fidlin |
| T-MACH-105970 | Structural Analysis of Composite Laminates | 4 CR | Kärger |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-105369 | Materials Modelling: Dislocation Based Plasticy | 4 CR | Weygand |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Angewandte Mechanik (Ü) ()** | | | |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After having finished this major field the students can

- list important mathematical concepts that are applied in mechanics
- analyze, evaluate and assess models of mechanics according to their mathematical structure
- apply mathematical algorithms for solving special problems in mechanics
- select a mathematical description of a given problem in mechanics

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.17 Module: Major Field: Automation Technology (SP 04) [M-MACH-102601]

**Responsible:** Prof. Dr. Ralf Mikut
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Automatisierungstechnik (K) (at least 8 credits)** | | | |
| T-MACH-105217 | Automation Systems | 4 CR | Kaufmann |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105539 | Modern Control Concepts I | 4 CR | Groell, Matthes |
| **Election block: Automatisierungstechnik (E) (at most 8 credits)** | | | |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105156 | Vehicle Mechatronics I | 4 CR | Ammon |
| T-MACH-105223 | Machine Vision | 8 CR | Lauer, Stiller |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | 4 CR | Gengenbach, Hagenmeyer, Koker, Sieber |
| T-MACH-106691 | Modern Control Concepts II | 4 CR | Groell |
| T-MACH-106692 | Modern Control Concepts III | 4 CR | Groell |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105990 | Simulation of Optical Systems | 4 CR | Sieber |
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| T-MACH-105443 | Wave Propagation | 4 CR | Seemann |
| T-MACH-109055 | Machine Tools and Industrial Handling | 8 CR | Fleischer |
| **Election block: Automatisierungstechnik (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | 4 CR | Stiller |
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |
| T-MACH-102149 | Virtual Reality Practical Course | 4 CR | Ovtcharova |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The Automation Engineering offers both theoretical foundations and practical knowledge in the field of automation. Students can select, apply and enhance existing methods. The main focus of the major is on

- Applied control engineering
- Automation
- Examples of field applications

Students of Automation Engineering are qualified to master complex challenges of the future. They are able to apply their profound knowledge and the future-oriented methods independent of a particular application field.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.18 Module: Major Field: Cognitive Technical Systems (SP 22) [M-MACH-102609]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Kognitive Technische Systeme (K) (at least 8 credits)** | | | |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| **Election block: Kognitive Technische Systeme (E) (at most 8 credits)** | | | |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-102128 | Information Systems and Supply Chain Management | 3 CR | Kilger |
| T-INFO-101466 | Information Processing in Sensor Networks | 6 CR | Hanebeck |
| T-MACH-105378 | Cognitive Automobiles - Laboratory | 6 CR | Kitt, Lauer, Stiller |
| T-INFO-101356 | Cognitive Systems | 6 CR | Dillmann, Waibel |
| T-INFO-101377 | Localization of Mobile Agents | 6 CR | Hanebeck |
| T-MACH-105223 | Machine Vision | 8 CR | Lauer, Stiller |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-INFO-101352 | Robotics III - Sensors in Robotics | 3 CR | Asfour |
| **Election block: Kognitive Technische Systeme (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | 4 CR | Stiller |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Students are able to

- explain fundamental components and processing steps of cognitive technical systems
- explain the interplay of individual components and the flow of information between them
- outline the major properties of cognitive functions at examples in emerging applications like vehicular technology or robotics
- determine the level of system function and safety for cognitive technical systems

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.19 Module: Major Field: Combustion Engines Based Powertrains (SP 58) [M-MACH-102650]

**Responsible:** Prof. Dr. Thomas Koch
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105564 | Energy Conversion and Increased Efficiency in Internal Combustion Engines | 4 CR | Koch, Kubach |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| **Election block: Verbrennungsmotorische Antriebssysteme (K) ()** | | | |
| T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | 4 CR | Deutschmann, Grunwaldt, Kubach, Lox |
| T-MACH-105167 | Analysis Tools for Combustion Diagnostics | 4 CR | Pfeil |
| T-MACH-105169 | Engine Measurement Techniques | 4 CR | Bernhardt |
| T-MACH-104609 | Combustion Engines II | 5 CR | Koch, Kubach |
| **Election block: Verbrennungsmotorische Antriebssysteme (E) ()** | | | |
| T-MACH-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | 4 CR | Gohl |
| T-MACH-105655 | Alternative Powertrain for Automobiles | 4 CR | Noreikat |
| T-MACH-105451 | Drive Systems and Possibilities to Increase Efficiency | 2 CR | Kollmeier |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-102162 | Automated Manufacturing Systems | 9 CR | Fleischer |
| T-MACH-105716 | Numerical Methods for combustion process development | 2 CR | Kubach, Waldenmaier |
| T-MACH-105184 | Fuels and Lubricants for Combustion Engines | 4 CR | Kehrwald, Kubach |
| T-MACH-105154 | Vehicle Comfort and Acoustics I | 4 CR | Gauterin |
| T-MACH-105155 | Vehicle Comfort and Acoustics II | 4 CR | Gauterin |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-100092 | Automotive Engineering I | 8 CR | Gauterin, Unrau |
| T-MACH-102117 | Automotive Engineering II | 4 CR | Gauterin, Unrau |
| T-MACH-105325 | Fundamentals of Combustion II | 4 CR | Maas |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-102199 | Model Based Application Methods | 4 CR | Kirschbaum |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105531 | Tribology | 8 CR | Dienwiebel, Scherge |
| T-MACH-105985 | Ignition systems | 4 CR | Toedter |
| **Election block: Verbrennungsmotorische Antriebssysteme (P) (at most 4 credits)** | | | |
| T-MACH-105337 | Engine Laboratory | 4 CR | Wagner |
| **Election block: Verbrennungsmotorische Antriebssysteme (Ü) ()** | | | |
| T-MACH-109303 | Exercices - Tribology | 0 CR | Dienwiebel |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completion of SP 48 students are able to:

- transfer fundamentals of thermodynamics and technical combustion to applications of combustion engines
- name and describe applications
- describe and explain the working principle of combustion engine and its application in vehicles
- analyze and evaluate propulsion systems

**Prerequisites**
None

**Content**
Energy converting machines are a key issue of technical engineering. Design and working principle are subject of the core area of SP 48. Fundamentals of thermodynamics are transferred to the application of internal combustion engines. In the supplementary area Measurement techniques to analyze and develop combustion engines as well as Fuels, Lubes and special engine concepts are addressed. The application of engines in drivetrains and production processes are continuative topics.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, tutorial.

## 2.20 Module: Major Field: Computational Mechanics (SP 06) [M-MACH-102604]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Computational Mechanics (K) (at least 8 credits)** | | | |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-MACH-105349 | Computational Dynamics | 4 CR | Proppe |
| T-MACH-105351 | Computational Mechanics I | 6 CR | Böhlke, Langhoff |
| **Election block: Computational Mechanics (E) (at most 8 credits)** | | | |
| T-MACH-105390 | Application of Advanced Programming Languages in Mechanical Engineering | 4 CR | Weygand |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-105391 | Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems | 4 CR | Günther |
| T-MACH-105394 | Finite Volume Methods for Fluid Flow | 4 CR | Günther |
| T-MACH-105396 | Modeling of Thermodynamical Processes | 6 CR | Maas, Schießl |
| T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | 4 CR | Wörner |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105397 | Numerical Simulation of Turbulent Flows | 4 CR | Grötzbach |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-105352 | Computational Mechanics II | 6 CR | Böhlke, Langhoff |
| **Election block: Computational Mechanics (P) (at most 4 credits)** | | | |
| T-MACH-105392 | FEM Workshop - Constitutive Laws | 4 CR | Schulz, Weygand |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The module offers a wide interdisciplinary education of the students in the areas which are summarized internationally under the concept 'Computational Mechanics':

* Continuum modelling (in structural mechanics, material theory, dynamics, fluid mechanics and thermodynamics)
* Numerical mathematics
* Informatics

Students know the procedures oriented to the future of modern engineering. They have the ability for individual, creative solutions of complicated problems with numerical means and take into account the interaction with neighboring fields.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.21 Module: Major Field: Development of Innovative Appliances and Power Tools (SP 51) [M-MACH-102642]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt (p))
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105229 | Appliance and Power Tool Design | 8 CR | Matthiesen |
| **Election block: Entwicklung innovativer Geräte (E) (at most 8 credits)** | | | |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-101910 | Microactuators | 4 CR | Kohl |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105696 | Strategic product development - identification of potentials of innovative products | 4 CR | Siebe |
| **Election block: Entwicklung innovativer Geräte (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Graduates are able to analyze and to synthesize complex technical products under consideration of customer, business and market demands. Specifically, they can address specific boundary conditions of devices and power tool manufacturers in power-tool development They and are able to take into account the resulting effects of complex product development projects: e.g. the production in large quantities, complexity of mechatronic solutions or workflow management of interdisciplinary and distributed development teams. The graduates are able to assess and optimize their work results in terms of quality, costs and user benefits. They have a holistic insight into the processes that are necessary for creating products in this specific context and thus are prepared for the technical and non-technical requirements of responsible positions in the team-oriented product development of devices and power tools.

**Prerequisites**
None

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105229 - Appliance and Power Tool Design must have been passed.

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, exercise.

## M 2.22 Module: Major Field: Energy Converting Engines (SP 24) [M-MACH-102627]

**Responsible:** Prof. Dr. Thomas Koch
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Kraft- und Arbeitsmaschinen (K) (at least 8 credits)** | | | |
| T-MACH-105326 | Hydraulic Fluid Machinery | 8 CR | Pritz |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| **Election block: Kraft- und Arbeitsmaschinen (E) ()** | | | |
| T-MACH-105649 | Boosting of Combustion Engines | 4 CR | Kech |
| T-CIWVT-105780 | Design of a jet engine combustion chamber | 6 CR | Zarzalis |
| T-MACH-105184 | Fuels and Lubricants for Combustion Engines | 4 CR | Kehrwald, Kubach |
| T-MACH-105512 | Experimental Fluid Mechanics | 4 CR | Kriegseis |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | 4 CR | Deutschmann, Grunwaldt, Kubach, Lox |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105325 | Fundamentals of Combustion II | 4 CR | Maas |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-107447 | Reliability Engineering 1 | 3 CR | Konnov |
| T-MACH-105364 | Thermal Turbomachines II | 6 CR | Bauer |
| T-MACH-105365 | Turbine and Compressor Design | 4 CR | Bauer |
| T-MACH-105366 | Turbo Jet Engines | 4 CR | Bauer |
| T-MACH-105234 | Windpower | 4 CR | Lewald |
| T-MACH-105784 | Vortex Dynamics | 4 CR | Kriegseis |
| **Election block: Kraft- und Arbeitsmaschinen (P) (at most 4 credits)** | | | |
| T-MACH-105515 | Introduction to Numerical Fluid Dynamics | 4 CR | Pritz |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Die Studierenden erwerben in den grundlagenorientierten Kernfächern des Schwerpunktes breite und fundierte Kenntnisse der wissenschaftlichen Theorien, Prinzipien und Methoden der Kraft- und Arbeitsmaschinen, um diese entwerfen, einsetzen und bewerten zu können.

Darauf aufbauend vertiefen die Studierenden in den Ergänzungsfächern ausgewählte Anwendungsfelder, sodass sie im Anschluss in der Lage sind, Probleme aus diesem Anwendungsfeld selbstständig zu analysieren, zu bewerten und hierauf aufbauend Lösungsansätze zu entwickeln.

Die Studierenden können nach Abschluss des Schwerpunkts insbesondere

- Funktion und Einsatz von Kraft- und Arbeitsmaschinen benennen,
- den Stand der Technik und daraus resultierende Anwendungsfelder der Kraft- und Arbeitsmaschinen beschreiben und am Beispiel anzuwenden,
- grundlegende Theorien, Methoden und Eigenschaften für die verschiedenen Anwendungsfelder der Kraft- und Arbeitsmaschinen benennen und diese einsetzen und bewerten.

**Prerequisites**
None

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, tutorial.

# 2.23 Module: Major Field: Energy Technology for Buildings (SP 55) [M-MACH-102648]

**Responsible:** Prof. Dr. Robert Stieglitz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105559 | Technical Energy Systems for Buildings 1: Processes & Components | 4 CR | Schmidt |
| **Election block: Gebäudeenergietechnik (K) (at least 4 credits)** | | | |
| T-MACH-105715 | Energy demand of buildings – fundamentals and applications, with building simulation exercises | 6 CR | Schmidt |
| T-MACH-105560 | Technical Energy Systems for Buildings 2: System Concept | 4 CR | Schmidt |
| **Election block: Gebäudeenergietechnik (E) (at most 8 credits)** | | | |
| T-MACH-105952 | Energy Storage and Network Integration | 4 CR | Jäger, Stieglitz |
| T-ARCH-107406 | Energy and Indoor Climate Concepts | 4 CR | Wagner |
| T-MACH-105408 | Energy Systems I: Renewable Energy | 6 CR | Dagan |
| T-ETIT-100724 | Photovoltaic System Design | 3 CR | Grab |
| T-MACH-105225 | Thermal Solar Energy | 4 CR | Stieglitz |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-105430 | Heatpumps | 4 CR | Maas, Wirbser |
| T-MACH-105234 | Windpower | 4 CR | Lewald |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completing the courses in SP 55 „Energy technology for buildings“ the students have achieved a comprehensive overview on the energy demand for air-conditioning of buildings (heating, cooling, humidification, dehumidification, ventilation) and the techniques for energy supply of buildings (heat, cold, locally generated electricity). They know the methods for evaluation of technologies regarding ecologic, criteria, primary energy and economic viability and they have the ability to apply these methods to concrete cases. They also have gained knowledge on all renewable energy technologies that are relevant for application in buildings, in particular solar thermal collectors and systems and photovoltaic systems as well as energy storage technologies that are applied in buildings (heat storage, batteries).

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, exercise.

# M 2.24 Module: Major Field: Engineering Design (SP 10) [M-MACH-102605]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Entwicklung und Konstruktion (K) (at least 8 credits)** | | | |
| T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | 4 CR | Albers, Ott |
| T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | 4 CR | Albers, Ott |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| **Election block: Entwicklung und Konstruktion (E) (at most 8 credits)** | | | |
| T-MACH-105215 | Applied Tribology in Industrial Product Development | 4 CR | Albers, Lorentz |
| T-MACH-105311 | Design and Development of Mobile Machines | 4 CR | Geimer, Siebert |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-108719 | Designing with numerical methods in product development | 4 CR | Schnack |
| T-MACH-108374 | Vehicle Ergonomics | 4 CR | Heine |
| T-MACH-102105 | Manufacturing Technology | 8 CR | Schulze, Zanger |
| T-MACH-100092 | Automotive Engineering I | 8 CR | Gauterin, Unrau |
| T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | 2 CR | Bardehle |
| T-MACH-102119 | Fundamentals for Design of Motor-Vehicle Bodies II | 2 CR | Bardehle |
| T-MACH-105160 | Fundamentals in the Development of Commercial Vehicles I | 2 CR | Zürn |
| T-MACH-105161 | Fundamentals in the Development of Commercial Vehicles II | 2 CR | Zürn |
| T-MACH-105162 | Fundamentals of Automobile Development I | 2 CR | Frech |
| T-MACH-105163 | Fundamentals of Automobile Development II | 2 CR | Frech |
| T-MACH-105188 | Integrative Strategies in Production and Development of High Performance Cars | 4 CR | Schlichtenmayer |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-105440 | Leadership and Conflict Management | 4 CR | Hatzl |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105696 | Strategic product development - identification of potentials of innovative products | 4 CR | Siebe |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105361 | Technical Design in Product Development | 4 CR | Schmid |
| T-MACH-109055 | Machine Tools and Industrial Handling | 8 CR | Fleischer |
| **Election block: Entwicklung und Konstruktion (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| **Election block: Entwicklung und Konstruktion (Ü) ()** | | | |

| | | | |
|---|---|---|---|
| T-MACH-108887 | Design and Development of Mobile Machines - Advance | 0 CR | Geimer, Siebert |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The students are able to transfer their knowledge und abilities in product engineering to mechanical systems in research and industrial practice.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

# M 2.25 Module: Major Field: Engineering Thermodynamics (SP 45) [M-MACH-102635]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of each Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Technische Thermodynamik (K) (at least 8 credits)** | | | |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105325 | Fundamentals of Combustion II | 4 CR | Maas |
| T-MACH-105396 | Modeling of Thermodynamical Processes | 6 CR | Maas, Schießl |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| **Election block: Technische Thermodynamik (E) (at most 8 credits)** | | | |
| T-MACH-105428 | Selected Chapters of the Combustion Fundamentals | 4 CR | Maas |
| T-MACH-106373 | Experimental techniques in thermo- and fluid-dynamics | 4 CR | Cheng |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105419 | Mathematical Models and Methods in Combustion Theory | 4 CR | Bykov, Maas |
| T-MACH-105167 | Analysis Tools for Combustion Diagnostics | 4 CR | Pfeil |
| T-MACH-105421 | Reduction Methods for the Modeling and the Simulation of Vombustion Processes | 4 CR | Bykov, Maas |
| T-MACH-105422 | Flows with Chemical Reactions | 4 CR | Class |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-105364 | Thermal Turbomachines II | 6 CR | Bauer |
| T-MACH-105429 | Combustion Diagnositics | 4 CR | Maas, Schießl |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| T-MACH-105430 | Heatpumps | 4 CR | Maas, Wirbser |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completion of SP 45 students are able to:

- apply the thermodynamic fundamentals of irreversible processes.
- explain the governing processes in combustion.
- outline the fundamentals of modeling and simulation of reacting flows.
- understand the working principle of technical systems applying thermodynamic processes and combustion.

**Prerequisites**
None

**Content**
Thermodynamics is considered to be the basis of all processes in nature and engineering. Combustion technology is still dominant as an energy conversion for power supply and for mobility applications. The major subject SP 45 extends the thermodynamic knowledge of the attandents in irreversible processes and provides insight into the fundamentals of reactive flows.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.26 Module: Major Field: Fluid Mechanic (SP 41) [M-MACH-102634]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Strömungsmechanik (K) (at least 8 credits)** | | | |
| T-MACH-105512 | Experimental Fluid Mechanics | 4 CR | Kriegseis |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105425 | Hydrodynamic Stability: From Order to Chaos | 4 CR | Class |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-MACH-105400 | Scaling in Fluid Dynamics | 4 CR | Bühler |
| T-MACH-105784 | Vortex Dynamics | 4 CR | Kriegseis |
| **Election block: Strömungsmechanik (E) (at most 6 credits)** | | | |
| T-MACH-105528 | Aerodynamics | 4 CR | Frohnapfel, Ohle |
| T-MACH-105437 | Aerothermodynamics | 4 CR | Frohnapfel, Seiler |
| T-MACH-105391 | Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems | 4 CR | Günther |
| T-MACH-105394 | Finite Volume Methods for Fluid Flow | 4 CR | Günther |
| T-MACH-105474 | Fluid-Structure-Interaction | 4 CR | Frohnapfel, Mühlhausen |
| T-BGU-109581 | Fluid Mechanics of Turbulent Flows | 4 CR | Uhlmann |
| T-MACH-105424 | Optical Flow Measurement: Fundamentals and Applications | 4 CR | Frohnapfel, Seiler |
| T-MACH-105375 | Industrial Aerodynamics | 4 CR | Breitling, Frohnapfel |
| T-MACH-105426 | Magnetohydrodynamics | 4 CR | Bühler |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | 4 CR | Wörner |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105397 | Numerical Simulation of Turbulent Flows | 4 CR | Grötzbach |
| T-MACH-105422 | Flows with Chemical Reactions | 4 CR | Class |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-105234 | Windpower | 4 CR | Lewald |
| T-MACH-105406 | Two-Phase Flow and Heat Transfer | 4 CR | Schulenberg, Wörner |
| **Election block: Strömungsmechanik (P) (at most 4 credits)** | | | |
| T-MACH-105313 | CFD-Lab Using Open Foam | 4 CR | Koch |
| T-MACH-105515 | Introduction to Numerical Fluid Dynamics | 4 CR | Pritz |
| T-MACH-105453 | Numerical Fluid Mechanics with MATLAB | 4 CR | Frohnapfel |
| T-MACH-105458 | Flow Simulations | 4 CR | Frohnapfel |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After having completed this module the student is capable of deriving the relevant fluid mechanical equations and interpret the governed physics. He/She can describe the characteristic properties of fluids and can analyze flow scenarios. According to the chosen lectures, the student can capture flow scenarios with analytical, numerical and/or experimental means and is capable to evaluate the acquired results thoroughly.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## 2.27 Module: Major Field: Fundamentals of Energy Technology (SP 15) [M-MACH-102623]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (mandatory)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105220 | Fundamentals of Energy Technology | 8 CR | Badea, Cheng |
| **Election block: Grundlagen der Energietechnik (K) ()** | | | |
| T-MACH-105525 | Introduction to Nuclear Energy | 4 CR | Cheng |
| T-MACH-105325 | Fundamentals of Combustion II | 4 CR | Maas |
| T-MACH-105326 | Hydraulic Fluid Machinery | 8 CR | Pritz |
| **Election block: Grundlagen der Energietechnik (E) ()** | | | |
| T-MACH-105462 | Selected Problems of Applied Reactor Physics and Exercises | 4 CR | Dagan |
| T-MACH-105184 | Fuels and Lubricants for Combustion Engines | 4 CR | Kehrwald, Kubach |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-105952 | Energy Storage and Network Integration | 4 CR | Jäger, Stieglitz |
| T-MACH-105408 | Energy Systems I: Renewable Energy | 6 CR | Dagan |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105167 | Analysis Tools for Combustion Diagnostics | 4 CR | Pfeil |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-ETIT-101939 | Photovoltaics | 6 CR | Powalla |
| T-MACH-105537 | Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle | 2 CR | Dagan |
| T-MACH-106493 | Solar Thermal Energy Systems | 4 CR | Dagan |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105225 | Thermal Solar Energy | 4 CR | Stieglitz |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| T-MACH-105234 | Windpower | 4 CR | Lewald |
| **Election block: Grundlagen der Energietechnik (P) (at most 4 credits)** | | | |
| T-MACH-105313 | CFD-Lab Using Open Foam | 4 CR | Koch |
| T-MACH-105515 | Introduction to Numerical Fluid Dynamics | 4 CR | Pritz |
| T-MACH-105331 | Laboratory Exercise in Energy Technology | 4 CR | Bauer, Maas, Wirbser |
| T-MACH-106707 | Workshop on computer-based flow measurement techniques | 4 CR | Bauer |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completion of SP 15 students are able:

- to describe the elements of an energy system and their complex interactions,
- to list different conventional energy sources and assess their static range,
- to name the fluctuating supply of renewable energies such as wind, solar radiation, ocean currents and tides etc. and describe its effects on the energy system,
- to assess the effects of external and internal economic, ecological and technical boundary conditions of energy systems and to derive approaches for an optimal mix of different energy technologies,
- to explain the operational principle of well-established power plants as well as of power plants based on renewable energies.

**Prerequisites**
None

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, tutorials.

# M 2.28 Module: Major Field: Fusion Technology (SP 53) [M-MACH-102643]

**Responsible:** Prof. Dr. Robert Stieglitz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Fusionstechnologie (K) (at least 8 credits)** | | | |
| T-MACH-105411 | Fusion Technology A | 4 CR | Stieglitz |
| T-MACH-105433 | Fusion Technology B | 4 CR | Stieglitz |
| T-ETIT-100663 | Radiation Protection: Ionising Radiation | 3 CR | Dössel |
| **Election block: Fusionstechnologie (E) (at most 10 credits)** | | | |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105407 | CFD in Power Engineering | 4 CR | Otic |
| T-MACH-106698 | A holistic approach to power plant management | 4 CR | Seidl, Stieglitz |
| T-MACH-105408 | Energy Systems I: Renewable Energy | 6 CR | Dagan |
| T-MACH-105434 | Magnet Technology of Fusion Reactors | 4 CR | Fietz, Weiss |
| T-MACH-105426 | Magnetohydrodynamics | 4 CR | Bühler |
| T-MACH-105435 | Neutron Physics of Fusion Reactors | 4 CR | Fischer |
| T-MACH-105456 | Ten Lectures on Turbulence | 4 CR | Otic |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-105406 | Two-Phase Flow and Heat Transfer | 4 CR | Schulenberg, Wörner |
| T-MACH-108784 | Vacuum and Tritium Technology in Nuclear Fusion | 4 CR | Bornschein, Day |

**Competence Certificate**
Oral exam: Acceptance for the oral test only by certification of attendance of excercises
(can be given in english)
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

**Competence Goal**
Graduate in fusion technology acquire a fundamental knowledge of the fusion process and are enabled to deduce based on the physical boundary conditions technological and scientific engineering solutions to individual problems. Since fusion technology is intrinsically of interdisciplinary nature consisiting of physics, mechanics, thermal-hydraulics, material sciences and electrical engineering incorporates, the focus of this topic is mainly devoted to allow for the understanding of the underlying physics and moreover to enable the students of couple the different disciplines. Here, mainly mehtodologies and solution approaches are communicated to the gradiuates with the goal to capture critical issues within multi-physics problems, to identify central challenges within the given problem and to enable them to elaborate engineering solution concepts. Aside from the analysis of the relevance/importance of aspects within a complex multi-physics problem graduates are prepared to take decisions based on a solid physics basis and to formulate solution approaches.

The reliable handling of different physical phenomena from different disciplines and the methodological capability to tackle multi-physics questions and to extract from them central core issues qualifies the graduates for a competent and successful career not only in fusion technology but also in neighboring fields such energy energiering as well as process, chemical and environmental engineering both in the research and development context but also in the project management.

**Prerequisites**
None

**Content**
Actual energy situation and perspectives. Elementary particle physics, principles of nuclear fusion and nuclear fission. What is a plasma and how it can be confined? How stable is a plasma and condtions for an ignition , control of a plasma and transport in plasmas. Plasmas are confined contactless by means of magnetic fields. Hence fundamentals of the magnet technology, super-conductivity, materials in super-conductivity, fabrication and design of magnets are elaborated.A fusion reactor breeds is own fuel Tritium, which is radioactive. Tritium poses specific requirements regarding separation, conditioning and the fuel cycle, for which the physical and technological basis are outlined. Fusion plasmas are characterized by a small particle density and hence a vacuum is required. Simultaneously plasmas generate high temperatures and heat loads necessitating dedicated designs of plasma facing components at a considerable neutron irradiation. in both technology fields the tasks, requirements and challenges are formulated and how they translate to the current "state of the art" are illustrated. Moreover, an introduction into design criteria and calculation methods to select adequate vacuum pumps and to design plasma facing components is provided.

**Recommendation**
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering

Basic knowledge in fluid mechanics, material sciences and physics

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, presentation (transparencies nearly exclusivley in english) complemented by print-outs and exercises

## M 2.29 Module: Major Field: Information Technology (SP 18) [M-MACH-102624]

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

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Informationstechnik (K) (at least 8 credits)** | | | |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-105223 | Machine Vision | 8 CR | Lauer, Stiller |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-105360 | Computer Engineering | 6 CR | Keller, Lorch |
| **Election block: Informationstechnik (E) ()** | | | |
| T-MACH-102150 | BUS-Controls | 4 CR | Becker, Geimer |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-102128 | Information Systems and Supply Chain Management | 3 CR | Kilger |
| T-MACH-105328 | Information Processing in Mechatronic Systems | 4 CR | Kaufmann |
| T-INFO-101466 | Information Processing in Sensor Networks | 6 CR | Hanebeck |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-105169 | Engine Measurement Techniques | 4 CR | Bernhardt |
| T-MACH-107447 | Reliability Engineering 1 | 3 CR | Konnov |
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| **Election block: Informationstechnik (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | 4 CR | Stiller |
| **Election block: Informationstechnik (Ü) ()** | | | |
| T-MACH-108889 | BUS-Controls - Advance | 0 CR | Daiß, Geimer |

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

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

### Competence Goal
Students are able to

- explain fundamentals of information technology for given problems in mechanical engineering an mechatronics.
- explain major methods for acquisition, processing and exploitation of information in technical systems.
- outline and to explain alternative methods to determine and to represent measurement uncertainties and their propagation in technical systems.
- explain information filters and fusion methods and understand their application to given problems.

### Prerequisites
none

**Content**

- Techniques of  information and data processing in mechanical engeneering
- Techniques of sensor data processing
- Concepts of controll theory
- Electronic devices for data processing

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, tutorials.

## 2.30 Module: Major Field: Information Technology of Logistic Systems (SP 19) [M-MACH-102625]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Informationstechnik für Logistiksysteme (K) (at least 8 credits)** | | | |
| T-MACH-102128 | Information Systems and Supply Chain Management | 3 CR | Kilger |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-102089 | Logistics - Organisation, Design and Control of Logistic Systems | 6 CR | Furmans |
| **Election block: Informationstechnik für Logistiksysteme (E) (at most 8 credits)** | | | |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105174 | Warehousing and Distribution Systems | 4 CR | Furmans |
| T-MACH-105175 | Airport Logistics | 4 CR | Richter |
| T-MACH-105181 | Supply Chain Management | 6 CR | Alicke |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Students are able to:

- Describe and explain soft- and hardware for logistical systems including Supply-Chains,
- Choose control mechanisms and communication systems and describe their basic functions,
- Compare strength and weaknesses of different approaches and evaluate the fundamental suitability.

**Prerequisites**
None

**Content**
This emphasis module focuses on automation technology in material flow as well as the information technology that has a direct relationship with it. Information sytems to support logistic processes are presented. It is shown how requirements of a supply chain can be identified and an appropriate information system can be choosen. Furthermore basic for the main topics of logistics are provided. To gain a deeper understanding, the courses are accompanied by exercises and partly by case studies.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures and practices; self-study

## M 2.31 Module: Major Field: Innovation and Entrepreneurship (SP 59) [M-MACH-104323]

**Responsible:** Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)

| Credits | Language | Level | Version |
|---|---|---|---|
| 16 | Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Innovation und Entrepreneurship (K) (at least 8 credits)** | | | |
| T-WIWI-102866 | Design Thinking | 3 CR | Terzidis |
| T-WIWI-102864 | Entrepreneurship | 3 CR | Terzidis |
| T-MACH-109185 | Innvative Project | 6 CR | Class, Terzidis |
| **Election block: Innovation und Entrepreneurship (E) (at most 8,5 credits)** | | | |
| T-WIWI-107501 | Energy Market Engineering | 4,5 CR | Weinhardt |
| T-WIWI-100806 | Renewable Energy-Resources, Technologies and Economics | 3,5 CR | Jochem, McKenna |
| T-WIWI-102865 | Business Planning | 3 CR | Terzidis |

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

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

**Competence Goal**
After completion of the module students

- know the principles of innovation and entrepreneurship
- can initiate patent research
- can name, compare and use the central methods and process models of product development within moderate complex technical systems.

**Prerequisites**
none

**Content**
The module introduces the basic concepts of entrepreneurship and illustrates the different stages of the dynamic development of a company.

The topics include:

- introduction to methods for generating innovative business ideas
- translating patents into business concepts
- general principles of financial planning
- the design and implementation of service-oriented information systems for Entrepreneurs
- Technology Management and Business Model Generation and “Lean Startup” methods for the implementation of business ideas by the way of controlled experiments in the market
- basics of product development.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours

**Learning type**
Seminar, lecture, project

## M 2.32 Module: Major Field: Integrated Product Development [M-MACH-102626]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt (p))
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch | 4 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105401 | Integrated Product Development | 16 CR | Albers, Albers Assistenten |

**Competence Certificate**
oral examination (60 minutes)

**Competence Goal**
By working practically in experience-based learning arrangements with industrial development tasks, graduates are able to succeed in new and unknown situations when developing innovative products by using methodological and systematic approaches. They can apply and adapt strategies of development and innovation management, technical system analysis and team leadership to the situation. As a result, they are able to foster the development of innovative products in industrial development teams in prominent positions, taking into account social, economic and ethical aspects.

**Prerequisites**
None

**Content**
Organizational integration: integrated product development model, core team management and simultaneous engineering, informational integration: innovation management, cost management, quality management and knowledge management

Personal integration: team development and leadership

Guest lectures from the industry

**Annotation**
The participation in "Integrated Product Development" requires the concurrent participation in lectures (2145156), tutorials (2145157) and project work (2145300).

Due to organizational reasons, the number of participants is limited. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
lecture
tutorial
product development project

# M 2.33 Module: Major Field: Lifecycle Engineering (SP 28) [M-MACH-102613]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt (p))
Specialization / Specialization: Production Technology (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-102123 | Virtual Engineering I | 4 CR | Ovtcharova |
| T-MACH-102124 | Virtual Engineering II | 4 CR | Ovtcharova |
| **Election block: Lifecycle Engineering (E) (at most 11 credits)** | | | |
| T-MACH-109933 | Business Administration for Engineers and IT professionals | 4 CR | Maier |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105312 | CATIA Advanced | 4 CR | Ovtcharova |
| T-MACH-108491 | Digitalization of Products, Services & Production | 4 CR | |
| T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | 4 CR | Stock |
| T-MACH-105388 | Introduction to Industrial Production Economics | 4 CR | Dürrschnabel |
| T-MACH-102209 | Information Engineering | 3 CR | Ovtcharova |
| T-MACH-106743 | IoT platform for engineering | 4 CR | Ovtcharova |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-102181 | PLM for Product Development in Mechatronics | 4 CR | Eigner |
| T-MACH-105147 | Product Lifecycle Management | 4 CR | Ovtcharova |
| T-MACH-105523 | Productivity Management in Production Systems | 4 CR | Stowasser |
| T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | 5 CR | Schulze |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105181 | Supply Chain Management | 6 CR | Alicke |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-106741 | Virtual training factory 4.X | 4 CR | Ovtcharova |
| T-MACH-106740 | Virtual Engineering Lab | 4 CR | Ovtcharova |
| T-MACH-102187 | CAD-NX Training Course | 2 CR | Ovtcharova |

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

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

**Competence Goal**
Student gain a basic understanding of holistic development, validation and production of products, components and systems.

Students are able to appreciate the product and process complexity of today's products and manufacturing facilities. They know exemplary IT-Systems to support the complexity.

Students can describe the necessary information management for the product emergence process.

Students know the fundamental terms or virtual reality and are able to use a CAVE as tool to promote technical or management decisions.

**Prerequisites**
None

**Content**
Virtual Engineering, methods of product development and production, CAD, CAE, CAx, Virtual and Augmented Reality, digital twin.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, exercises, project work in teams, workshop, Learning by Doing

# M 2.34 Module: Major Field: Lightweight Construction (SP 25) [M-MACH-102628]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | 4 CR | Henning |
| T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 4 CR | Henning |
| **Election block: Leichtbau (E) (at most 9 credits)** | | | |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-108721 | Designing with Composites | 4 CR | Schnack |
| T-MACH-105320 | Introduction to the Finite Element Method | 5 CR | Böhlke, Langhoff |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-105157 | Foundry Technology | 4 CR | Wilhelm |
| T-MACH-100296 | Advanced Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105164 | Laser in Automotive Engineering | 4 CR | Schneider |
| T-MACH-105166 | Materials and Processes for Body Leightweight Construction in the Automotive Industry | 4 CR | Kienzle, Steegmüller |
| T-MACH-108717 | Mechanics of Laminated Composites | 4 CR | Schnack |
| T-MACH-102137 | Polymer Engineering I | 4 CR | Elsner |
| T-MACH-105971 | Simulation of the process chain of continuously fiber reinforced composite structure | 4 CR | Kärger |
| T-MACH-105970 | Structural Analysis of Composite Laminates | 4 CR | Kärger |
| T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | 4 CR | Gruber, Gumbsch |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| T-MACH-105211 | Materials of Lightweight Construction | 4 CR | Weidenmann |
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Lightweight design is the realization of a development strategy, which aims at fulfilling a required function over the product life under specified boundary conditions by a system of minimal weight.

Therefore, lightweight design can always be described as an optimization problem, that must be solved as efficiently as possible by suitable measures. With regard to the automotive industry, this means reducing the total vehicle weight without negatively affecting important properties such as the bodywork stiffness or crash characteristics.

In order to solve the optimization problem of lightweight design technically and economically efficient, an interdisciplinary approach is required. This means that specific know-how is required in many areas of materials science and engineering, as well as interdisciplinary thinking.

Exploiting the full potential of lightweight design therefore requires the systematic development of materials, the development and adaption of suitable manufacturing and finishing processes, as well as the development of simulation tools and design methods for innovative lightweight constructions.

Students acquire the skill to name the basics of lightweight design and to apply them to problems in various areas of mechanical engineering, in particular materials, methods and production.

As an elementary component of the module, the students can explain and apply the materials relevant for lightweight design. The students are able to describe and compare the materials important for lightweight design and to select the corresponding methods for construction, design and dimensioning under consideration of suitable manufacturing technologies.

Based on examples, which are also used in industry, the students learn to select suitable materials, to describe them with suitable methods and to develop products under consideration of the manufacturing process. The students learn to analyze processes and to assess their efficiency.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## 2.35 Module: Major Field: Logistics and Material Flow Theory (SP 29) [M-MACH-102629]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-102151 | Material Flow in Logistic Systems | 6 CR | Furmans |
| **Election block: Logistik und Materialflusslehre (K) (at least 2 credits)** | | | |
| T-MACH-102089 | Logistics - Organisation, Design and Control of Logistic Systems | 6 CR | Furmans |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| **Election block: Logistik und Materialflusslehre (E) (at most 8 credits)** | | | |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-102159 | Elements and Systems of Technical Logistics | 4 CR | Fischer, Mittwollen |
| T-MACH-108946 | Elements and Systems of Technical Logistics - Project | 2 CR | Fischer, Mittwollen |
| T-MACH-108848 | Global Production and Logistics - Part 1: Global Production | 4 CR | Lanza |
| T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics | 4 CR | Furmans |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-102128 | Information Systems and Supply Chain Management | 3 CR | Kilger |
| T-MACH-105174 | Warehousing and Distribution Systems | 4 CR | Furmans |
| T-MACH-105165 | Automotive Logistics | 4 CR | Furmans |
| T-MACH-105175 | Airport Logistics | 4 CR | Richter |
| T-WIWI-103091 | Production and Logistics Controlling | 3 CR | Rausch |
| T-MACH-105523 | Productivity Management in Production Systems | 4 CR | Stowasser |
| T-MACH-105181 | Supply Chain Management | 6 CR | Alicke |
| T-MACH-105346 | Production Techniques Laboratory | 4 CR | Deml, Fleischer, Furmans, Ovtcharova |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Students

- acquire comprehensive and well-founded knowledge on the main topics of logistics, an overview of different logistic questions in practice and knows the functionality of material handling systems,
- are able to illustrate logistic systems with adequate accuracy by using simple models,
- are able to realize coherences within logistic systems,
- are able to evaluate logistic systems by using the learnt methods,
- are able to analyze and explain the phenomena of industrial material and value streams
- are able to plan logistic systems and evaluate their performance,
- can use approaches of Supply Chain Management within the operational practice,
- identify, analyse and evaluate risks within logistic systems.

**Prerequisites**
None

**Content**
The emphasis module *Material Flow and Logistics* provides comprehensive and well-founded basics for the main topics of logistics. Within the lectures, the interaction between several components of logistic systems will be shown. The module focuses on technical characteristics of material handling systems as well as on methods for illustrating and evaluating logistics systems. Furthermore the main topics of logistics and industrial material and value streams can be focused on by queuing methods to model production systems. Another focus can be set on basic methods for planning and running logistic systems or special issues like supply chain management. To gain a deeper understanding, the courses are accompanied by exercises and partly by case studies.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures and practices; self-study

## 2.36 Module: Major Field: Man - Technology - Organisation (SP 03) [M-MACH-102600]

**Responsible:** Prof. Dr.-Ing. Barbara Deml
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105518 | Human Factors Engineering I | 4 CR | Deml |
| T-MACH-105519 | Human Factors Engineering II | 4 CR | Deml |
| **Election block: Mensch - Technik - Organisation (E) (at most 8 credits)** | | | |
| T-MACH-105830 | Human Factors Engineering III: Empirical research methods | 4 CR | Deml |
| T-MACH-108374 | Vehicle Ergonomics | 4 CR | Heine |
| T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | 4 CR | Stock |
| T-MACH-105388 | Introduction to Industrial Production Economics | 4 CR | Dürrschnabel |
| T-MACH-105386 | Occupational Safety and Environmental Protection | 4 CR | von Kiparski |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-105440 | Leadership and Conflict Management | 4 CR | Hatzl |
| T-MACH-105387 | Planning of Assembly Systems | 4 CR | Haller |
| T-MACH-105470 | Production Planning and Control | 4 CR | Rinn |
| T-MACH-105523 | Productivity Management in Production Systems | 4 CR | Stowasser |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105361 | Technical Design in Product Development | 4 CR | Schmid |

**Competence Certificate**
In the core area of Major Field at least 8 ECTS have to be chosen.

**Competence Goal**
The students acquire a basic knowledge in the field of 1. ergonomics and 2. work organisation:

1. 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.
2. Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization. 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. Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

Further on they get to know basic methods of behavioral-science data acquisition (e. g. eye-tracking, ECG, dual-task-paradigm) and they gain a first insight into empirical research methods (e. g. experimental design, statistical data evaluation). Selected complementary subjects deepen or extend the above mentioned learning outcomes.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## 2.37 Module: Major Field: Materials Science and Engineering (SP 26) [M-MACH-102611]

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

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105301 | Materials Science and Engineering III | 8 CR | Heilmaier |
| **Election block: Materialwissenschaft und Werkstofftechnik (E) ()** | | | |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-102141 | Constitution and Properties of Wearresistant Materials | 4 CR | Ulrich |
| T-MACH-105150 | Constitution and Properties of Protective Coatings | 4 CR | Ulrich |
| T-MACH-105984 | Fatigue of Welded Components and Structures | 3 CR | Farajian, Gumbsch |
| T-MACH-105157 | Foundry Technology | 4 CR | Wilhelm |
| T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR | Schell |
| T-MACH-108717 | Mechanics of Laminated Composites | 4 CR | Schnack |
| T-MACH-100287 | Introduction to Ceramics | 6 CR | Hoffmann |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105164 | Laser in Automotive Engineering | 4 CR | Schneider |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105333 | Mechanics and Strength of Polymers | 4 CR | von Bernstorff |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-105532 | Nonlinear Continuum Mechanics | 5 CR | Böhlke |
| T-MACH-105516 | Multi-Scale Plasticity | 4 CR | Greiner, Schulz |
| T-MACH-102137 | Polymer Engineering I | 4 CR | Elsner |
| T-MACH-102157 | High Performance Powder Metallurgy Materials | 4 CR | Oberacker |
| T-MACH-105724 | Failure Analysis | 4 CR | Greiner, Schneider |
| T-MACH-105170 | Welding Technology | 4 CR | Farajian |
| T-MACH-105354 | Fatigue of Metallic Materials | 4 CR | Lang |
| T-MACH-102179 | Structural Ceramics | 4 CR | Hoffmann |
| T-MACH-105362 | Technology of Steel Components | 4 CR | Schulze |
| T-MACH-108853 | Hydrogen in Materials | 4 CR | Pundt |
| T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | 4 CR | Gruber, Gumbsch |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| T-MACH-107684 | Materials Characterization | 6 CR | Gibmeier |
| T-MACH-105211 | Materials of Lightweight Construction | 4 CR | Weidenmann |
| T-MACH-107667 | Solid State Reactions and Kinetics of Phase | 6 CR | Franke, Seifert |
| T-MACH-105369 | Materials Modelling: Dislocation Based Plasticy | 4 CR | Weygand |

| | | | |
|---|---|---|---|
| T-MACH-107670 | Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | 6 CR | Franke, Seifert |
| **Election block: Materialwissenschaft und Werkstofftechnik (P) (at most 4 credits)** | | | |
| T-MACH-105447 | Metallographic Lab Class | 4 CR | Hauf |
| T-MACH-102154 | Laboratory Laser Materials Processing | 4 CR | Schneider |
| T-MACH-105651 | Biomechanics: design in nature and inspired by nature | 4 CR | Mattheck |
| **Election block: Materialwissenschaft und Werkstofftechnik (Ü) ()** | | | |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |
| T-MACH-107685 | Exercises for Materials Characterization | 0 CR | Gibmeier |
| T-MACH-107632 | Exercises for Solid State Reactions and Kinetics of Phase Transformations | 0 CR | Franke, Seifert |

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

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

**Competence Goal**
As part of a major field a specific subdomain of mechanical engineering is made accessible in breadth and depth. Students gain comprehensive knowledge in the core subjects and detailed knowledge in the supplementary subjects of the selected subdomain. They are able to generate new (scientific) solutions within this subdomain.

The specific learning outcomes are defined by the respective coordinator of the major field.

**Prerequisites**
None

**Content**
The comprehensive topic of the major field are the thermodynamical and kinetic basics of materials science that the students acquire within the core area (8 credit points). Moreover, there is a supplementary area of materials science and engineering which offers different subjects according to the students' interests.

**Annotation**
The module Materials Science and Engineering consists of 16 credit points in the master´s program. Within that module, the students have to take lectures from a core area (8 credit points) and can select from a broad variation of courses within the supplementary area. For the bachelor´s program, a reduced catalogue exists (see Studienplan).

**Workload**
The work load is about 480 hours in the Master of Science program, whereof the presence time is 82 h.

**Learning type**
In the core area of the major field Materials Science and Engineering the students choose from a small number of lectures and tutorials (obligatory).

Within the supplementary area students can choose not only lectures and tutorials but also lab courses and seminars.

# M 2.38 Module: Major Field: Mechatronics (SP 31) [M-MACH-102614]

**Responsible:** Prof. Dr. Veit Hagenmeyer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

| | | | |
|---|---|---|---|
| **Election block: Mechatronik (K) (at least 8 credits)** | | | |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105539 | Modern Control Concepts I | 4 CR | Groell, Matthes |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| **Election block: Mechatronik (E) ()** | | | |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105217 | Automation Systems | 4 CR | Kaufmann |
| T-MACH-102150 | BUS-Controls | 4 CR | Becker, Geimer |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-ETIT-100784 | Hybrid and Electric Vehicles | 4 CR | Becker |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-108957 | Mathematical Fundamentals of Numerical Mechanics | 4 CR | Schnack |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-INFO-101266 | Human-Machine-Interaction | 6 CR | Beigl |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | 4 CR | Gengenbach, Hagenmeyer, Koker, Sieber |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-ETIT-109313 | Signals and Systems | 6 CR | Puente León |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| **Election block: Mechatronik (P) (at most 4 credits)** | | | |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |

| | | | |
|---|---|---|---|
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |
| T-MACH-102149 | Virtual Reality Practical Course | 4 CR | Ovtcharova |
| **Election block: Mechatronik (Ü) ()** | | | |
| T-MACH-108889 | BUS-Controls - Advance | 0 CR | Daiß, Geimer |
| T-INFO-106257 | Human-Machine-Interaction | 0 CR | Beigl |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The topic mechatronics offers a broad, multidisciplinary body of knowledge. The graduates are qualified to solve essential mechatronic questions. In particular the following disciplines are covered by the major mechatronics:

§ Mechanics and fluidics

§ Electronics

§ Information processing

§ Automation.

Students of the topic mechatronics know the future-oriented procedures. They are able to individually and creatively solve interdisciplinary questions and learn to effectively combine tools from the individual disciplines.

**Prerequisites**
none

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, tutorial.

# M 2.39 Module: Major Field: Medical Technology (SP 32) [M-MACH-102615]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| **Election block: Medizintechnik (K) (at least 2 credits)** | | | |
| T-ETIT-106492 | Biomedical Measurement Techniques I | 3 CR | Nahm |
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |
| T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 4 CR | Guber |
| T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 4 CR | Guber |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-105235 | Principles of Medicine for Engineers | 4 CR | Pylatiuk |
| **Election block: Medizintechnik (E) (at most 8 credits)** | | | |
| T-MACH-105238 | Actuators and Sensors in Nanotechnology | 4 CR | Kohl |
| T-ETIT-101930 | Medical Imaging Techniques I | 3 CR | Dössel |
| T-ETIT-101931 | Medical Imaging Techniques II | 3 CR | Dössel |
| T-ETIT-101956 | Bioelectric Signals | 3 CR | Loewe |
| T-ETIT-106973 | Biomedical Measurement Techniques II | 3 CR | Nahm |
| T-MACH-102172 | Bionics for Engineers and Natural Scientists | 4 CR | Hölscher |
| T-INFO-101262 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | 3 CR | Dillmann, Spetzger |
| T-MACH-105228 | Organ Support Systems | 4 CR | Pylatiuk |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-ETIT-101937 | Measurement | 5 CR | Puente León |
| T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | 4 CR | Gengenbach, Hagenmeyer, Koker, Sieber |
| T-ETIT-100664 | Nuclear Medicine and Measuring Techniques I | 1 CR | Dössel |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | 5 CR | Schulze |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-INFO-105723 | Robotics II: Humanoid Robotics | 3 CR | Asfour |
| T-INFO-101352 | Robotics III - Sensors in Robotics | 3 CR | Asfour |
| T-INFO-101357 | Medical Robotics | 3 CR | Kröger, Raczkowsky |

| | | | |
|---|---|---|---|
| T-MACH-105990 | Simulation of Optical Systems | 4 CR | Sieber |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| T-MACH-102164 | Practical Training in Basics of Microsystem Technology | 4 CR | Last |

**Competence Certificate**
In the core area of Major Field at least 8 ECTS have to be chosen.

**Competence Goal**
The Medical Engineering qualifies students to solve challenges in the field of complex medical and biomedical systems supporting human-centred diagnostics and therapy. Based on the specific requirements for medical products the following topics are taught within the major Medical Engineering:

- Broad basis of relevant medical and biological knowledge
- Measuring technology and signal processing
- Development and Manufacturing of medical products

Graduates of this major know all relevant methods to design modern medical devices and have the ability to efficiently and creatively develop solutions for leading edge medical applications.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.40 Module: Major Field: Microactuators and Microsensors (SP 54) [M-MACH-102647]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Mikroaktoren und Mikrosensoren (K) (at least 8 credits)** | | | |
| T-MACH-101910 | Microactuators | 4 CR | Kohl |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| **Election block: Mikroaktoren und Mikrosensoren (E) (at most 11 credits)** | | | |
| T-MACH-105238 | Actuators and Sensors in Nanotechnology | 4 CR | Kohl |
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |
| T-MACH-105321 | Introduction to Theory of Materials | 4 CR | Kamlah |
| T-MACH-102166 | Fabrication Processes in Microsystem Technology | 4 CR | Bade |
| 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-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | 4 CR | Dienwiebel, Hölscher, Walheim |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| T-MACH-105782 | Micro Magnetic Resonannce | 4 CR | Korvink, MacKinnon |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
- Knowledge of the principles of actuation and sensing including pros and cons
- Knowledge of the underlying concepts of materials science and technology
on different lengths scales
- Explanation of layout and function of important actuators and sensors
- Calculation of important properties (time constants, forces, displacements,
sensitivity, etc.)
- Development of a layout based on specifications

**Prerequisites**
none

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, exercise.

## M 2.41 Module: Major Field: Microsystem Technology (SP 33) [M-MACH-102616]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| 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 |
| **Election block: Mikrosystemtechnik (E) (at most 10 credits)** | | | |
| T-MACH-105238 | Actuators and Sensors in Nanotechnology | 4 CR | Kohl |
| T-MACH-102176 | Current Topics on BioMEMS | 4 CR | Guber |
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |
| T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 4 CR | Guber |
| T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 4 CR | Guber |
| T-MACH-102172 | Bionics for Engineers and Natural Scientists | 4 CR | Hölscher |
| T-MACH-102166 | Fabrication Processes in Microsystem Technology | 4 CR | Bade |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-MACH-105557 | Microenergy Technologies | 4 CR | Kohl |
| T-MACH-101910 | Microactuators | 4 CR | Kohl |
| T-MACH-108383 | Microsystem Simulation | 4 CR | Korvink |
| T-MACH-105814 | Microsystem product design for young entrepreneurs | 6 CR | Korvink |
| T-MACH-108613 | Miniaturized Heat Exchangers | 4 CR | Brandner |
| T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | 4 CR | Dienwiebel, Hölscher, Walheim |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-102192 | Polymers in MEMS A: Chemistry, Synthesis and Applications | 4 CR | Rapp |
| T-MACH-102191 | Polymers in MEMS B: Physics, Microstructuring and Applications | 4 CR | Worgull |
| T-MACH-102200 | Polymers in MEMS C: Biopolymers and Bioplastics | 4 CR | Rapp, Worgull |
| T-MACH-109122 | X-ray Optics | 4 CR | Last |
| **Election block: Mikrosystemtechnik (P) (at most 4 credits)** | | | |
| T-MACH-108407 | NMR micro probe hardware conception and construction | 4 CR | Korvink |
| T-MACH-105556 | Practical Course Polymers in MEMS | 2 CR | Rapp, Worgull |
| T-MACH-102164 | Practical Training in Basics of Microsystem Technology | 4 CR | Last |
| T-MACH-105782 | Micro Magnetic Resonannce | 4 CR | Korvink, MacKinnon |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
In this key area, attendees gain competence in the design, construction, production, and application of **micro and nano systems**. Microsystems comprise the **smallest human-made** components. These include sensors, actuators, and system components working together for form a more powerful whole. Micro and nano systems are the basis for numerous smart products, such as **smart dust**, smart buildings, the **internet of things**, smart consumer-ware, smart mobility, and smart production via **industry 4.0** concepts.

The **increasing control** over morphology at the nano and microscale is enabling the bottom up construction of **passive and active materials** with ideal and unheard-of properties, embedded in the devices that can make use of these, and are therefore **revolutionising** the world of products and scientific instrumentation.

**Prerequisites**
none

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.42 Module: Major Field: Mobile Machines (SP 34) [M-MACH-102630]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105168 | Mobile Machines | 8 CR | Geimer |
| **Election block: Mobile Arbeitsmaschinen (E) ()** | | | |
| T-MACH-105307 | Drive Train of Mobile Machines | 4 CR | Geimer, Wydra |
| T-MACH-105311 | Design and Development of Mobile Machines | 4 CR | Geimer, Siebert |
| T-MACH-102150 | BUS-Controls | 4 CR | Becker, Geimer |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-108374 | Vehicle Ergonomics | 4 CR | Heine |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105160 | Fundamentals in the Development of Commercial Vehicles I | 2 CR | Zürn |
| T-MACH-105161 | Fundamentals in the Development of Commercial Vehicles II | 2 CR | Zürn |
| T-MACH-102093 | Fluid Power Systems | 4 CR | Geimer, Pult |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-105172 | Simulation of Coupled Systems | 4 CR | Geimer, Xiang |
| T-MACH-105423 | Tractors | 4 CR | Becker, Geimer, Kremmer |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| **Election block: Mobile Arbeitsmaschinen (Ü) ()** | | | |
| T-MACH-108889 | BUS-Controls - Advance | 0 CR | Daiß, Geimer |
| T-MACH-108888 | Simulation of Coupled Systems - Advance | 0 CR | Geimer, Xiang |
| T-MACH-108887 | Design and Development of Mobile Machines - Advance | 0 CR | Geimer, Siebert |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The student

- knows and understands the basic structure of the machines,
- masters the basic skills to develop the selected machines

**Prerequisites**
None

**Content**

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**

- Research-oriented teaching
- lectures
- exercises

## M 2.43 Module: Major Field: Modeling and Simulation in Dynamics (SP 61) [M-MACH-104434]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt (p))

| Credits | Language | Level | Version |
|---|---|---|---|
| 16 | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of each Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Modellbildung und Simulation in der Dynamik (K) (at least 8 credits)** | | | |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| **Election block: Modellbildung und Simulation in der Dynamik (E) (at most 9 credits)** | | | |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105172 | Simulation of Coupled Systems | 4 CR | Geimer, Xiang |
| T-MACH-105514 | Experimental Dynamics | 5 CR | Fidlin |
| T-MACH-105349 | Computational Dynamics | 4 CR | Proppe |
| T-MACH-105384 | Computerized Multibody Dynamics | 4 CR | Seemann |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| **Election block: Modellbildung und Simulation in der Dynamik (Ü) ()** | | | |
| T-MACH-108888 | Simulation of Coupled Systems - Advance | 0 CR | Geimer, Xiang |

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

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

**Competence Goal**
The module provides modeling competences and continues thus the compulsory courses in dynamics. To this end analytical methods for the modeling and examination of dynamical systems are presented. The simulation of the systems enables the students to do simulation studies in typical applications in dynamical systems of mechanical engineering to be able to evaluate and interpret the results.

**Prerequisites**
none

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours.

**Learning type**
Lectures, Tutorials

## M 2.44 Module: Major Field: Modeling and Simulation in Energy- and Fluid Engineering (SP 27) [M-MACH-102612]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

### Election notes
In the core area of Major Field at least 8 ECTS have to be chosen.

| Election block: Modellierung und Simulation in der Energie- und Strömungstechnik (K) (at least 8 credits) | | | |
|---|---|---|---|
| T-MACH-105396 | Modeling of Thermodynamical Processes | 6 CR | Maas, Schießl |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| **Election block: Modellierung und Simulation in der Energie- und Strömungstechnik (E) (at most 8 credits)** | | | |
| T-MACH-105407 | CFD in Power Engineering | 4 CR | Otic |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105419 | Mathematical Models and Methods in Combustion Theory | 4 CR | Bykov, Maas |
| T-MACH-105167 | Analysis Tools for Combustion Diagnostics | 4 CR | Pfeil |
| T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | 4 CR | Wörner |
| T-MACH-105397 | Numerical Simulation of Turbulent Flows | 4 CR | Grötzbach |
| T-MACH-105421 | Reduction Methods for the Modeling and the Simulation of Vombustion Processes | 4 CR | Bykov, Maas |
| T-MACH-105422 | Flows with Chemical Reactions | 4 CR | Class |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| T-MACH-105456 | Ten Lectures on Turbulence | 4 CR | Otic |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-102149 | Virtual Reality Practical Course | 4 CR | Ovtcharova |

### Competence Certificate
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

### Competence Goal
After completing the students can:

- formulate the governing equations for specific systems in energy and fluid mechanics.
- explain the different numerical schemes applied to solve the system of equations.
- use frequently applied simulation tools in a more efficient and successful way.

### Prerequisites
None

### Content
See brick courses.

### Workload
The work load is about 480 hours, corresponding to 16 credit points.

### Learning type
Lectures, Tutorials

# M 2.45 Module: Major Field: Nuclear Energy (SP 21) [M-MACH-102608]

**Responsible:** Prof. Dr.-Ing. Xu Cheng

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Kerntechnik (K) (at least 8 credits)** | | | |
| T-MACH-105525 | Introduction to Nuclear Energy | 4 CR | Cheng |
| T-MACH-105402 | Nuclear Power Plant Technology | 4 CR | Badea, Cheng, Schulenberg |
| **Election block: Kerntechnik (E) (at most 8 credits)** | | | |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105407 | CFD in Power Engineering | 4 CR | Otic |
| T-MACH-105530 | Fundamentals of reactor safety for the operation and dismantling of nuclear power plants | 4 CR | Sanchez-Espinoza |
| T-MACH-105550 | Energy systems II: Reactor Physics | 4 CR | Badea |
| T-MACH-105404 | Innovative Nuclear Systems | 4 CR | Cheng |
| T-MACH-105466 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | 4 CR | Dagan |
| T-MACH-105405 | Reactor Safety I: Fundamentals | 4 CR | Sanchez-Espinoza |
| T-MACH-105403 | Flows and Heat Transfer in Energy Technology | 4 CR | Cheng |
| T-MACH-105456 | Ten Lectures on Turbulence | 4 CR | Otic |
| T-MACH-105406 | Two-Phase Flow and Heat Transfer | 4 CR | Schulenberg, Wörner |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
Students acquire the basic and advanced knowledge of nuclear technology and are able to apply the assimilated knowledge in practice and to analyze and solve by themselves important questions in the nuclear energy field.

The courses of this module are built on three levels. With the overview lecture "Introduction into Nuclear Power", the students acquire broad basic knowledge of nuclear energy and are able to further study in-depth courses in various disciplines, namely thermal-hydraulics, reactor physics and materials science. As a result, students will understand the important processes of nuclear technology, such as control, heat transport and material behavior in a nuclear reactor. The properties of various nuclear systems, especially nuclear power plants, are available for study on the third level of the lectures. The students will possess then the ability to compare and analyze different nuclear systems.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

# M 2.46 Module: Major Field: Polymer Engineering (SP 36) [M-MACH-102632]

**Responsible:** Prof. Dr.-Ing. Peter Elsner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of each Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Polymerengineering (K) (at least 8 credits)** | | | |
| T-MACH-102137 | Polymer Engineering I | 4 CR | Elsner |
| T-MACH-102138 | Polymer Engineering II | 4 CR | Elsner |
| **Election block: Polymerengineering (E) (at most 8 credits)** | | | |
| T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | 4 CR | Henning |
| T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 4 CR | Henning |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105333 | Mechanics and Strength of Polymers | 4 CR | von Bernstorff |
| T-MACH-105971 | Simulation of the process chain of continuously fiber reinforced composite structure | 4 CR | Kärger |
| T-MACH-105970 | Structural Analysis of Composite Laminates | 4 CR | Kärger |

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

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

**Competence Goal**
The students...

- are able to choose polymers for abblications in mechanical engineering in target-oriented way and are able to justify their selection.
- are able to describe and compare production processes for polymers and PMCs exemplarily.
- are able to describe the mechanical behaviour of polymers and PMC based on scientific theories, principles and methods.
- are able to solve tasks in the field of polymer engineering and proceed adequate to the situation.
- are able to integrate intra-modular knowledge at the solution of given problems.
- have the ability to develop polymer parts in a constructive way under consideration of technical and economic conditions.

**Prerequisites**
None

**Content**
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.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

# M 2.47 Module: Major Field: Power Plant Technology (SP 23) [M-MACH-102610]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

| | | | |
|---|---|---|---|
| **Election block: Kraftwerkstechnik (K) (at least 8 credits)** | | | |
| T-MACH-105410 | Coal Fired Power Plants | 4 CR | Schulenberg |
| T-MACH-105444 | Combined Cycle Power Plants | 4 CR | Schulenberg |
| T-MACH-105326 | Hydraulic Fluid Machinery | 8 CR | Pritz |
| T-MACH-105402 | Nuclear Power Plant Technology | 4 CR | Badea, Cheng, Schulenberg |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-105364 | Thermal Turbomachines II | 6 CR | Bauer |
| **Election block: Kraftwerkstechnik (E) ()** | | | |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105525 | Introduction to Nuclear Energy | 4 CR | Cheng |
| T-MACH-105952 | Energy Storage and Network Integration | 4 CR | Jäger, Stieglitz |
| T-MACH-105411 | Fusion Technology A | 4 CR | Stieglitz |
| T-MACH-105213 | Fundamentals of Combustion I | 4 CR | Maas, Sommerer |
| T-MACH-105386 | Occupational Safety and Environmental Protection | 4 CR | von Kiparski |
| T-MACH-105404 | Innovative Nuclear Systems | 4 CR | Cheng |
| T-MACH-105414 | Cooling of Thermally High Loaded Gas Turbine Components | 4 CR | Bauer, Schulz |
| T-MACH-105338 | Numerical Fluid Mechanics | 4 CR | Magagnato |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-107447 | Reliability Engineering 1 | 3 CR | Konnov |
| T-MACH-105354 | Fatigue of Metallic Materials | 4 CR | Lang |
| T-MACH-105445 | Simulator Exercises Combined Cycle Power Plants | 2 CR | Schulenberg |
| T-MACH-105225 | Thermal Solar Energy | 4 CR | Stieglitz |
| T-MACH-106372 | Thermal-Fluid-Dynamics | 4 CR | Ruck |
| T-MACH-105365 | Turbine and Compressor Design | 4 CR | Bauer |
| T-MACH-105416 | Hydrogen Technologies | 4 CR | Jordan |
| T-MACH-105234 | Windpower | 4 CR | Lewald |
| T-MACH-105406 | Two-Phase Flow and Heat Transfer | 4 CR | Schulenberg, Wörner |
| **Election block: Kraftwerkstechnik (P) (at most 4 credits)** | | | |
| T-MACH-105515 | Introduction to Numerical Fluid Dynamics | 4 CR | Pritz |
| T-MACH-105331 | Laboratory Exercise in Energy Technology | 4 CR | Bauer, Maas, Wirbser |
| T-MACH-106707 | Workshop on computer-based flow measurement techniques | 4 CR | Bauer |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completion of SP 23 students are able:

- to name the different types of centralized and distributed power plants,
- to explain the operational principle of well-established power plants as well as of power plants based on renewable energies.
- to predict the electric, respectively thermal efficiency of power plants,
- to assess the economics of power plants,
- to highlight the environmental impact of conventional power plants and of renewable energies,
- to assess the availability, operational safety and flexibility of different types of power plants,
- to develop advanced power plants based on thermodynamic, fluid mechanical and other basics.

**Prerequisites**
None

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, tutorials.

# M 2.48 Module: Major Field: Powertrain Systems (SP 02) [M-MACH-102599]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of each Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Antriebssysteme (K) (at least 8 credits)** | | | |
| T-MACH-105307 | Drive Train of Mobile Machines | 4 CR | Geimer, Wydra |
| T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | 4 CR | Albers, Ott |
| T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | 4 CR | Albers, Ott |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| **Election block: Antriebssysteme (E) (at most 8 credits)** | | | |
| T-MACH-105215 | Applied Tribology in Industrial Product Development | 4 CR | Albers, Lorentz |
| T-MACH-105536 | Dimensioning and Optimization of Power Train System | 4 CR | Faust, Kirchner |
| T-MACH-105209 | Introduction into the Multi-Body Dynamics | 5 CR | Seemann |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-ETIT-100784 | Hybrid and Electric Vehicles | 4 CR | Becker |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105696 | Strategic product development - identification of potentials of innovative products | 4 CR | Siebe |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105531 | Tribology | 8 CR | Dienwiebel, Scherge |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| **Election block: Antriebssysteme (Ü) ()** | | | |
| T-MACH-109303 | Exercices - Tribology | 0 CR | Dienwiebel |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The students know and understand the technical and physical basics and systematic connections of drive systems. The lecture deals vehicle drive systems as well as drive systems for stationary and mobile work machines.

They are able to choose, describe and use complex dimensioning- and design methods for drive systems under consideration of the interactions of the system.

**Prerequisites**
none

**Content**
See brick courses

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

# M 2.49 Module: Major Field: Production Technology (SP 39) [M-MACH-102618]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Produktionstechnik (K) (at least 8 credits)** | | | |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-102105 | Manufacturing Technology | 8 CR | Schulze, Zanger |
| T-MACH-108848 | Global Production and Logistics - Part 1: Global Production | 4 CR | Lanza |
| T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics | 4 CR | Furmans |
| T-MACH-108849 | Integrated Production Planning in the Age of Industry 4.0 | 8 CR | Lanza |
| T-MACH-109055 | Machine Tools and Industrial Handling | 8 CR | Fleischer |
| **Election block: Produktionstechnik (E) (at most 8 credits)** | | | |
| T-MACH-102159 | Elements and Systems of Technical Logistics | 4 CR | Fischer, Mittwollen |
| T-MACH-108946 | Elements and Systems of Technical Logistics - Project | 2 CR | Fischer, Mittwollen |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-106878 | Design Project Production Science for E-mobility (DPEM) | 4 CR | Fleischer |
| T-MACH-105227 | Design Project Machine Tools and Industrial Handling | 4 CR | Fleischer |
| T-MACH-105157 | Foundry Technology | 4 CR | Wilhelm |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | 4 CR | Stock |
| T-MACH-105388 | Introduction to Industrial Production Economics | 4 CR | Dürrschnabel |
| T-MACH-105188 | Integrative Strategies in Production and Development of High Performance Cars | 4 CR | Schlichtenmayer |
| T-MACH-105174 | Warehousing and Distribution Systems | 4 CR | Furmans |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Ploch |
| T-MACH-105783 | Learning Factory “Global Production“ | 4 CR | Lanza |
| T-MACH-105165 | Automotive Logistics | 4 CR | Furmans |
| T-MACH-105166 | Materials and Processes for Body Leightweight Construction in the Automotive Industry | 4 CR | Kienzle, Steegmüller |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105387 | Planning of Assembly Systems | 4 CR | Haller |
| T-MACH-105340 | PLM in the Manufacturing Industry | 4 CR | Ovtcharova |
| T-MACH-105470 | Production Planning and Control | 4 CR | Rinn |
| T-MACH-105523 | Productivity Management in Production Systems | 4 CR | Stowasser |
| T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | 5 CR | Schulze |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105170 | Welding Technology | 4 CR | Farajian |
| T-MACH-108737 | Seminar Data-Mining in Production | 3 CR | Lanza |

| | | | |
|---|---|---|---|
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105362 | Technology of Steel Components | 4 CR | Schulze |
| T-MACH-105177 | Metal Forming | 4 CR | Herlan |
| T-MACH-102148 | Gear Cutting Technology | 4 CR | Klaiber |
| **Election block: Produktionstechnik (P) (at most 4 credits)** | | | |
| T-MACH-102099 | Experimental Lab Class in Welding Technology, in Groups | 4 CR | Dietrich |
| T-MACH-102154 | Laboratory Laser Materials Processing | 4 CR | Schneider |
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |
| T-MACH-105346 | Production Techniques Laboratory | 4 CR | Deml, Fleischer, Furmans, 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**
The students …

- are able to analyze new situations and choose methods of production science target-oriented based on the analyses, as well as justifying their selection.
- are able to describe and compare complex production processes exemplarily.
- are able to generate new solutions in the field of production science under consideration of scientific theories, principles and methods.
- are able to solve tasks in the field of production science team oriented and proceed responsible and adequate to the situation.
- are able to integrate the results of others at the solution of given problems.
- have the ability to state results in written form developed in a team, and are able to interpret and present them with self-chosen methods.
- are able to identify, dissect and develop further systems and processes and apply given sets of criteria under consideration of technical, economic and social conditions.

**Prerequisites**
None

**Content**
Within this module the students will get to know and learn about production science. Manifold lectures and excursions as part of several lectures provide specific insights into the field of production science.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, seminars, workshops, excursions

# M 2.50 Module: Major Field: Rail System Technology (SP 50) [M-MACH-102641]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt (p))
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-106424 | Rail System Technology | 4 CR | Gratzfeld |
| T-MACH-105353 | Rail Vehicle Technology | 4 CR | Gratzfeld |
| **Election block: Bahnsystemtechnik (E) (at most 10 credits)** | | | |
| T-MACH-105540 | Railways in the Transportation Market | 4 CR | Gratzfeld |
| T-MACH-102121 | Electric Rail Vehicles | 4 CR | Gratzfeld |
| T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | 4 CR | Henning |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 4 CR | Henning |
| T-MACH-104599 | Project Management in Rail Industry | 4 CR | Gratzfeld |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-108692 | Seminar for Rail System Technology | 3 CR | Gratzfeld |

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

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

**Competence Goal**

- The students understand relations and interdependencies between rail vehicles, infrastructure and operation in a rail system.
- Based on operating requirements and legal framework they derive the requirements concerning a capable infrastructure and suitable concepts of rail vehicles.
- They recognize the impact of alignment, understand the important function of the wheel-rail-contact and estimate the impact of driving dynamics on the operating program.
- They evaluate the impact of operating concepts on safety and capacity of a rail system.
- They know the infrastructure to provide power supply to rail vehicles with different drive systems.
- The students learn the role of rail vehicles and understand their classification. They understand the basic structure und know the functions of the main systems. They understand the overall tasks of vehicle system technology.
- They learn functions and requirements of car bodies and jugde advantages and disadvantages of design principles. They know the functions of the car body's interfaces.
- They know about the basics of running dynamics and bogies.
- The students learn about advantages and disadvantages of different types of traction drives and judge, which one fits best for each application.
- They understand brakes from a vehicular and an operational point of view. They assess the fitness of different brake systems.
- They know the basic setup of train control management system and understand the most important functions.
- They specify and define suitable vehicle concepts based on requirements for modern rail vehicles.
- Supplementary lectures present further major aspects of a rail system.

**Prerequisites**
None

**Content**

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. Vehicle system technology: structure and main systems of rail vehicles
9. Car body: functions, requirements, design principles, crash elements, interfaces
10. Bogies: forces, running gears, axle configuration
11. Drives: vehicle with/without contact wire, dual-mode vehicle
12. Brakes: tasks, basics, principles, blending, brake control
13. Train control management system: definitions, networks, bus systems, components, examples
14. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons
15. History (optional)
16. Further contents in supplementary lectures

**Annotation**
A bibliography is available for download (Ilias-platform).

**Workload**

- Total effort at 16 ECTS (M.Sc.): about 480 hours
- Regular attendance: 84 hours
- Self-study: 84 hours
- Exam and preparation: 312 hours

**Learning type**
Lectures in the core part.

Lectures and seminars are offered in the supplementary part.

# 2.51 Module: Major Field: Reliability in Mechanical Engineering (SP 49) [M-MACH-102602]

**Responsible:** Prof. Dr. Peter Gumbsch
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt (p))

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | 4 CR | Gruber, Gumbsch |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| **Election block: Zuverlässigkeit im Maschinenbau (E) ()** | | | |
| T-MACH-105390 | Application of Advanced Programming Languages in Mechanical Engineering | 4 CR | Weygand |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105320 | Introduction to the Finite Element Method | 5 CR | Böhlke, Langhoff |
| T-MACH-105321 | Introduction to Theory of Materials | 4 CR | Kamlah |
| T-MACH-105984 | Fatigue of Welded Components and Structures | 3 CR | Farajian, Gumbsch |
| T-MACH-105324 | Foundations of Nonlinear Continuum Mechanics | 4 CR | Kamlah |
| T-MACH-100296 | Advanced Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105334 | Mechanics in Microtechnology | 4 CR | Greiner, Gruber |
| T-MACH-105303 | Modelling of Microstructures | 5 CR | August, Nestler |
| T-MACH-105516 | Multi-Scale Plasticity | 4 CR | Greiner, Schulz |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105724 | Failure Analysis | 4 CR | Greiner, Schneider |
| T-MACH-105354 | Fatigue of Metallic Materials | 4 CR | Lang |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105369 | Materials Modelling: Dislocation Based Plasticy | 4 CR | Weygand |
| T-MACH-100532 | Scientific Computing for Engineers | 5 CR | Gumbsch, Weygand |
| **Election block: Zuverlässigkeit im Maschinenbau (P) (at most 4 credits)** | | | |
| T-MACH-105392 | FEM Workshop - Constitutive Laws | 4 CR | Schulz, Weygand |
| T-MACH-105417 | Finite Element Workshop | 4 CR | Mattheck, Weygand |
| **Election block: Zuverlässigkeit im Maschinenbau (Ü) ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |
| T-MACH-109304 | Excercises - Fatigue of Welded Components and Structures | 1 CR | Farajian, Gumbsch |

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

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

**Competence Goal**
After attending the core subjects "failure of structural materials: fatigue and creep" (T-MACH-102139) and "failure of structural materials: deformation and fracture"(T-MACH-102140) the students will gain the following skills:

- They have the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- They 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.
- They can decribe the main empirical materials models for fatigue and creep as well as for deformation and fracture and can apply them.
- They have the physical understanding to describe and explain phenomena of failure.
- They can use statistical approaches for reliability predictions.
- They can use its acquired skills, to select and develop materials for specific applications.

The additional learning outcomes depend on which further lectures are selected and are explicitly described there.

**Prerequisites**
None

**Content**
In addition to the core subjects "failure of structural materials: fatigue and creep" (T-MACH-102139) and "failure of structural materials: deformation and fracture" (T-MACH-102140), the student has to choose two more lectures, which deal with specific problems of reliability of components and systems in mechanical engineering.

For detailed information see the description of the different courses of the module.

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

**Annotation**
The module Reliability in Mechanical Engineering consists of 16 credit points in the master´s program. Within that module, the students have to pass bricks T-MACH-105531 and T-MACH-109303 from the core area (8 credit points) and can select from a broad variation of courses within the supplementary area.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
In the core area of the major field Materials Science and Engineering the students have to pass bricks T-MACH-102139 and T-MACH-102140 (obligatory).

Within the supplementary area students can choose not only lectures and tutorials but also lab courses and seminars.

# M 2.52 Module: Major Field: Robotics (SP 40) [M-MACH-102633]

**Responsible:** Prof. Dr. Ralf Mikut
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Robotik (K) (at least 8 credits)** | | | |
| T-MACH-105314 | Computational Intelligence | 4 CR | Jakob, Mikut, Reischl |
| T-MACH-105694 | Data Analytics for Engineers | 5 CR | Ludwig, Mikut, Reischl |
| T-MACH-100535 | Introduction into Mechatronics | 6 CR | Böhland, Lorch, Reischl |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-INFO-108014 | Robotics I - Introduction to Robotics | 6 CR | Asfour |
| T-INFO-105723 | Robotics II: Humanoid Robotics | 3 CR | Asfour |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| **Election block: Robotik (E) (at most 8 credits)** | | | |
| T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | 4 CR | Albers, Ott |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105317 | Digital Control | 4 CR | Knoop |
| T-MACH-105378 | Cognitive Automobiles - Laboratory | 6 CR | Kitt, Lauer, Stiller |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-INFO-101377 | Localization of Mobile Agents | 6 CR | Hanebeck |
| T-MACH-105223 | Machine Vision | 8 CR | Lauer, Stiller |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MACH-105335 | Measurement II | 4 CR | Stiller |
| T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | 4 CR | Gengenbach, Hagenmeyer, Koker, Sieber |
| T-MACH-105539 | Modern Control Concepts I | 4 CR | Groell, Matthes |
| T-MACH-102152 | Novel Actuators and Sensors | 4 CR | Kohl, Sommer |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-105384 | Computerized Multibody Dynamics | 4 CR | Seemann |
| T-INFO-101352 | Robotics III - Sensors in Robotics | 3 CR | Asfour |
| T-MACH-105185 | Control Technology | 4 CR | Gönnheimer |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-105555 | System Integration in Micro- and Nanotechnology | 4 CR | Gengenbach |
| T-MACH-105360 | Computer Engineering | 6 CR | Keller, Lorch |
| **Election block: Robotik (P) (at most 4 credits)** | | | |
| T-INFO-105142 | Humanoid Robots - Practical Course | 3 CR | Asfour |
| T-MACH-105370 | Laboratory Mechatronics | 4 CR | Lorch, Seemann, Stiller |
| T-MACH-108878 | Laboratory Production Metrology | 4 CR | Häfner |

| | | | |
|---|---|---|---|
| T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | 4 CR | Stiller |
| T-MACH-102149 | Virtual Reality Practical Course | 4 CR | Ovtcharova |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The Robotics offers extensive knowledge to develop, design and manufacture future intelligent robots. The following scientific disciplines are covered during the major Robotics:

- Control systems and control theory
- Actuators and sensors
- Mathematical and descriptive methods

The students of the major Robotics have the essential skills necessary to develop future robotic systems for modern applications.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lecture, tutorial.

# M 2.53 Module: Major Field: Technical Ceramics and Powder Materials (SP 43) [M-MACH-102619]

**Responsible:** Prof. Dr. Michael Hoffmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Technische Keramik und Pulverwerkstoffe (K) (at least 8 credits)** | | | |
| T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR | Schell |
| T-MACH-100287 | Introduction to Ceramics | 6 CR | Hoffmann |
| T-MACH-106722 | Ceramic Matrix Composites | 4 CR | Koch |
| T-MACH-102179 | Structural Ceramics | 4 CR | Hoffmann |
| **Election block: Technische Keramik und Pulverwerkstoffe (E) (at most 8 credits)** | | | |
| T-MACH-106723 | Bionic Inspired Reinforced Composites | 4 CR | Koch |
| T-MACH-102182 | Ceramic Processing Technology | 4 CR | Binder |
| T-MACH-102157 | High Performance Powder Metallurgy Materials | 4 CR | Oberacker |
| T-MACH-102170 | Structural and Phase Analysis | 4 CR | Wagner |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| **Election block: Technische Keramik und Pulverwerkstoffe (P) (at most 4 credits)** | | | |
| T-MACH-105178 | Practical Course Technical Ceramics | 1 CR | Oberacker |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The students acquire comprehensive and fundamental knowledge of preparation, processing and characterization of technical powders, their consolidation by various shaping techiques and the densification by sintering. They know the manifold possibilities of microstructural design of powdermetallurgical parts and are able to discuss the microstructure property relationships.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.54 Module: Major Field: Technical Logistics (SP 44) [M-MACH-102640]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-102163 | Basics of Technical Logistics | 6 CR | Mittwollen, Oellerich |
| **Election block: Technische Logistik (K) (at least 2 credits)** | | | |
| T-MACH-102160 | Selected Applications of Technical Logistics | 4 CR | Milushev, Mittwollen |
| T-MACH-102159 | Elements and Systems of Technical Logistics | 4 CR | Fischer, Mittwollen |
| T-MACH-108946 | Elements and Systems of Technical Logistics - Project | 2 CR | Fischer, Mittwollen |
| T-MACH-108945 | Selected Applications of Technical Logistics - Project | 2 CR | Milushev, Mittwollen |
| **Election block: Technische Logistik (E) (at most 9 credits)** | | | |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105151 | Energy Efficient Intralogistic Systems | 4 CR | Braun, Schönung |
| T-MACH-105187 | IT-Fundamentals of Logistics | 4 CR | Thomas |
| T-MACH-105378 | Cognitive Automobiles - Laboratory | 6 CR | Kitt, Lauer, Stiller |
| T-MACH-105174 | Warehousing and Distribution Systems | 4 CR | Furmans |
| T-MACH-102151 | Material Flow in Logistic Systems | 6 CR | Furmans |
| T-WIWI-103091 | Production and Logistics Controlling | 3 CR | Rausch |
| T-MACH-102107 | Quality Management | 4 CR | Lanza |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |

**Competence Certificate**
see brick courses

**Competence Goal**
Students are able to:

- Describe main functional elements of of technical logistics,
- Determine the main parameters necessary for functionality,
- Combines those functional elements to solve material handling tasks appropriate, and
- Evalute resulting material handling installations.

**Prerequisites**
None

**Content**
The emphasis module *Technical Logistics* provides in-depth basics on the main topics of technical logistics. The module focuses on technical characteristics of material handling technology. To gain a deeper understanding, the course is accompanied by exercises.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures and practices; self-study

## M 2.55 Module: Major Field: Thermal Turbomachines (SP 46) [M-MACH-102636]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105363 | Thermal Turbomachines I | 6 CR | Bauer |
| T-MACH-105364 | Thermal Turbomachines II | 6 CR | Bauer |
| **Election block: Thermische Turbomaschinen (E) ()** | | | |
| T-MACH-105310 | Design of Highly Stresses Components | 4 CR | Aktaa |
| T-MACH-105512 | Experimental Fluid Mechanics | 4 CR | Kriegseis |
| T-MACH-105444 | Combined Cycle Power Plants | 4 CR | Schulenberg |
| T-MACH-105533 | Gasdynamics | 4 CR | Magagnato |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105414 | Cooling of Thermally High Loaded Gas Turbine Components | 4 CR | Bauer, Schulz |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | 4 CR | Koch |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-107447 | Reliability Engineering 1 | 3 CR | Konnov |
| T-MACH-105354 | Fatigue of Metallic Materials | 4 CR | Lang |
| T-MACH-105171 | Safety Engineering | 4 CR | Kany |
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-105365 | Turbine and Compressor Design | 4 CR | Bauer |
| T-MACH-105366 | Turbo Jet Engines | 4 CR | Bauer |
| T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | 4 CR | Gruber, Gumbsch |
| T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | 4 CR | Gumbsch, Weygand |
| T-MACH-105784 | Vortex Dynamics | 4 CR | Kriegseis |
| **Election block: Thermische Turbomaschinen (P) (at most 4 credits)** | | | |
| T-MACH-106707 | Workshop on computer-based flow measurement techniques | 4 CR | Bauer |
| T-MACH-105445 | Simulator Exercises Combined Cycle Power Plants | 2 CR | Schulenberg |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
After completion of SP 46 students are able to:

- identify and quantify the specific requirements of different applications in the fields of energy technology, aeronautics, car and motor technology and process technology on thermal turbo machines,
- apply the basics of thermodynamics, fluid mechanics and of other generic disciplines to analyse and design turbo machines and their components,
- explain the governing processes in turbo machines such as compression, combustion and expansion,
- Recognise and exploit the potentials to further improve the economics and environmental friendliness of turbo machines, their components and in their interaction with the overarching systems, like power plant or airplane,
- Explain the operational principle of turbo machines and the related generics.

**Prerequisites**
None

**Content**
Thermal turbo machines are driving generators of power plants to generate electric energy. In aeronautics turbofan, turboprop and turboshaft engines are the dominating propulsion systems for airplanes and helicopters due to their high specific power-to-weight ratio and efficiency. Turbochargers are providing increased power and efficiency to internal combustion engines. Turbocompressors are used in multiple applications in chemical and process industry. In the major subject “Thermal Turbo Machines” students learn to apply their basic knowledge in thermodynamics, fluid mechanics, technical mechanics and other generic disciplines to analyse and develop challenging applications.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

## M 2.56 Module: Major Field: Tribology (SP 47) [M-MACH-102637]

**Responsible:** Prof. Dr. Martin Dienwiebel
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)
Specialization / Specialization: Materials and Structures for High Performance Systems (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Mandatory** | | | |
| T-MACH-105531 | Tribology | 8 CR | Dienwiebel, Scherge |
| T-MACH-109303 | Exercices - Tribology | 0 CR | Dienwiebel |
| **Election block: Tribologie (E) ()** | | | |
| T-MACH-105215 | Applied Tribology in Industrial Product Development | 4 CR | Albers, Lorentz |
| T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | 4 CR | Albers, Ott |
| T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | 4 CR | Brandl, Gumbsch, Schneider |
| T-MACH-102141 | Constitution and Properties of Wearresistant Materials | 4 CR | Ulrich |
| T-MACH-105786 | Contact Mechanics | 4 CR | Greiner |
| T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | 4 CR | Dienwiebel, Hölscher, Walheim |
| T-MACH-102167 | Nanotribology and -Mechanics | 4 CR | Dienwiebel, Hölscher |
| T-MACH-102137 | Polymer Engineering I | 4 CR | Elsner |
| T-MACH-105724 | Failure Analysis | 4 CR | Greiner, Schneider |
| T-MACH-102103 | Superhard Thin Film Materials | 4 CR | Ulrich |
| **Election block: Tribologie (P) (at most 4 credits)** | | | |
| T-MACH-105813 | Practical Course “Tribology” | 4 CR | Dienwiebel, Schneider |

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

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

**Competence Goal**
After attending the core subject "tribology" ( 2181114) the students have the following skills:

- They can describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems.
- They can evaluate the friction and wear behavior of tribological systems.
- They can explain the effects of lubricants and their most important additives.
- They can identify suitable approaches to optimize tribological systems.
- They 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.
- They can 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.
- The can describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces.

The additional learning outcomes depend on which further lectures are selected and are explicitly described there.

**Prerequisites**
None

**Content**
In addition to the core subject "tribology" (bricks T-MACH-105531 and T-MACH-109303), the student has to choose two more lectures, which deal with specific problems of tribology, e.g. in the field of product deveolpment, simulation or materials selection.

For detailed information see the description of the different courses of the module.

**Annotation**
The module Tribology consists of 16 credit points in the master´s program. Within that module, the students have to pass bricks T-MACH-105531 and T-MACH-109303 from the core area (8 credit points) and can select from a broad variation of courses within the supplementary area.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
In the core area of the major field Materials Science and Engineering the students have to pass bricks T-MACH-105531 and T-MACH-109303 (obligatory).

Within the supplementary area students can choose not only lectures and tutorials but also lab courses and seminars.

# M 2.57 Module: Major Field: Vehicle Dynamics, Vehicle Comfort and Acoustics (SP 11) [M-MACH-102606]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Fahrdynamik, Fahrzeugkomfort und -akustik (K) (at least 8 credits)** | | | |
| T-MACH-105154 | Vehicle Comfort and Acoustics I | 4 CR | Gauterin |
| T-MACH-105155 | Vehicle Comfort and Acoustics II | 4 CR | Gauterin |
| **Election block: Fahrdynamik, Fahrzeugkomfort und -akustik (E) (at most 11 credits)** | | | |
| T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | 4 CR | Albers, Ott |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| T-MACH-105152 | Handling Characteristics of Motor Vehicles I | 4 CR | Unrau |
| T-MACH-105153 | Handling Characteristics of Motor Vehicles II | 4 CR | Unrau |
| T-MACH-108374 | Vehicle Ergonomics | 4 CR | Heine |
| T-MACH-105156 | Vehicle Mechatronics I | 4 CR | Ammon |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-102117 | Automotive Engineering II | 4 CR | Gauterin, Unrau |
| T-MACH-105375 | Industrial Aerodynamics | 4 CR | Breitling, Frohnapfel |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105539 | Modern Control Concepts I | 4 CR | Groell, Matthes |
| T-MACH-105349 | Computational Dynamics | 4 CR | Proppe |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-105384 | Computerized Multibody Dynamics | 4 CR | Seemann |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| T-MACH-105443 | Wave Propagation | 4 CR | Seemann |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The student

• knows and understands the dynamic characteristics of vehicles, owing to the construction and design tokens,

• knows and understands especially the factors being relevant for comfort and acoustics,

• is capable of fundamentally evaluating and rating handling characteristics.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, Tutorials

# M 2.58 Module: Major Field: Vehicle Technology (SP 12) [M-MACH-102607]

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

**Part of:** Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Vehicle Technology (Schwerpunkt (p))
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 16 | Once | Deutsch/Englisch | 4 | 2 |

**Election notes**
In the core area of Majo Field at least 8 ECTS have to be chosen.

| | | | |
|---|---|---|---|
| **Election block: Kraftfahrzeugtechnik (K) (at least 8 credits)** | | | |
| T-MACH-100092 | Automotive Engineering I | 8 CR | Gauterin, Unrau |
| **Election block: Kraftfahrzeugtechnik (E) (at most 8 credits)** | | | |
| T-MACH-105655 | Alternative Powertrain for Automobiles | 4 CR | Noreikat |
| T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | 4 CR | Albers, Ott |
| T-MACH-105536 | Dimensioning and Optimization of Power Train System | 4 CR | Faust, Kirchner |
| T-MACH-108844 | Automated Manufacturing Systems | 8 CR | Fleischer |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| T-MACH-105152 | Handling Characteristics of Motor Vehicles I | 4 CR | Unrau |
| T-MACH-105153 | Handling Characteristics of Motor Vehicles II | 4 CR | Unrau |
| T-MACH-108374 | Vehicle Ergonomics | 4 CR | Heine |
| T-MACH-105154 | Vehicle Comfort and Acoustics I | 4 CR | Gauterin |
| T-MACH-105155 | Vehicle Comfort and Acoustics II | 4 CR | Gauterin |
| T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | 4 CR | Henning |
| T-MACH-105156 | Vehicle Mechatronics I | 4 CR | Ammon |
| T-MACH-102207 | Tires and Wheel Development for Passenger Cars | 4 CR | Leister |
| T-MACH-105218 | Automotive Vision | 6 CR | Lauer, Stiller |
| T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 4 CR | Henning |
| T-MACH-102117 | Automotive Engineering II | 4 CR | Gauterin, Unrau |
| T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | 4 CR | Deutschmann, Grunwaldt, Kubach, Lox |
| T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | 2 CR | Bardehle |
| T-MACH-102119 | Fundamentals for Design of Motor-Vehicle Bodies II | 2 CR | Bardehle |
| T-MACH-105160 | Fundamentals in the Development of Commercial Vehicles I | 2 CR | Zürn |
| T-MACH-105161 | Fundamentals in the Development of Commercial Vehicles II | 2 CR | Zürn |
| T-MACH-105162 | Fundamentals of Automobile Development I | 2 CR | Frech |
| T-MACH-105163 | Fundamentals of Automobile Development II | 2 CR | Frech |
| T-ETIT-100784 | Hybrid and Electric Vehicles | 4 CR | Becker |
| T-MACH-105375 | Industrial Aerodynamics | 4 CR | Breitling, Frohnapfel |
| T-MACH-105188 | Integrative Strategies in Production and Development of High Performance Cars | 4 CR | Schlichtenmayer |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt, Revfi |
| T-MACH-105164 | Laser in Automotive Engineering | 4 CR | Schneider |
| T-MACH-105166 | Materials and Processes for Body Lightweight Construction in the Automotive Industry | 4 CR | Kienzle, Steegmüller |

| | | | |
|---|---|---|---|
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Zacharias |
| T-MACH-102155 | Product, Process and Resource Integration in the Automotive Industry | 4 CR | Ovtcharova |
| T-MACH-102156 | Project Workshop: Automotive Engineering | 6 CR | Frey, Gauterin, Gießler |
| T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | 4 CR | Ays, Geerling |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Gutzmer |
| T-MACH-105350 | Computational Vehicle Dynamics | 4 CR | Proppe |
| T-MACH-105696 | Strategic product development - identification of potentials of innovative products | 4 CR | Siebe |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Ziegahn |
| T-MACH-102194 | Combustion Engines I | 4 CR | Koch, Kubach |
| T-MACH-105367 | Behaviour Generation for Vehicles | 4 CR | Stiller, Werling |
| T-MACH-102148 | Gear Cutting Technology | 4 CR | Klaiber |

**Competence Certificate**
Oral exams: duration approx. 5 min. per credit point. However, amount, type and scope of the success control can vary according to the individually choice.

**Competence Goal**
The student

• knows the most important components of a vehicle,

• knows and understands the functioning and the interaction of the individual components,

• knows the basics of dimensioning the components,

• knows and understands the procedures in automobile development,

• knows and understands the technical specifications at the development procedures,

• is aware of notable boundaries like legislation,

• is ready to analyze and judge vehicle concepts and to participate competently in the development of vehicles.

**Prerequisites**
None

**Content**
See brick courses.

**Workload**
The work load is about 480 hours, corresponding to 16 credit points.

**Learning type**
Lectures, tutorials.

# M 2.59 Module: Major Field: Vibration Theory (SP 60) [M-MACH-104443]

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

**Part of:**
Specialization / Specialization: General Mechanical Engineering (Schwerpunkte)
Specialization / Specialization: Energy- and Environment Engineering (Schwerpunkt)
Specialization / Specialization: Vehicle Technology (Schwerpunkt)
Specialization / Specialization: Mechatronics and Microsystems Technology (Schwerpunkt)
Specialization / Specialization: Product Development and Engineering Design (Schwerpunkt)
Specialization / Specialization: Production Technology (Schwerpunkt)
Specialization / Specialization: Theoretical Mechanical Engineering (Schwerpunkt (p))

| Credits | Language | Level | Version |
|---|---|---|---|
| 16 | Deutsch/Englisch | 4 | 1 |

**Election notes**
In the core area of Major Field at least 8 ECTS have to be chosen.

| Election block: Schwingungslehre (K) (at least 8 credits) | | | |
|---|---|---|---|
| T-MACH-105290 | Vibration Theory | 5 CR | Fidlin |
| T-MACH-105210 | Machine Dynamics | 5 CR | Proppe |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105372 | Theory of Stability | 6 CR | Fidlin |
| **Election block: Schwingungslehre (E) (at most 9 credits)** | | | |
| T-MACH-105224 | Machine Dynamics II | 4 CR | Proppe |
| T-MACH-105443 | Wave Propagation | 4 CR | Seemann |
| T-MACH-105226 | Dynamics of the Automotive Drive Train | 5 CR | Fidlin |
| T-MACH-105514 | Experimental Dynamics | 5 CR | Fidlin |
| T-MACH-105439 | Introduction to Nonlinear Vibrations | 7 CR | Fidlin |
| T-MACH-105154 | Vehicle Comfort and Acoustics I | 4 CR | Gauterin |
| T-MACH-105155 | Vehicle Comfort and Acoustics II | 4 CR | Gauterin |
| T-MACH-105349 | Computational Dynamics | 4 CR | Proppe |
| T-MACH-105373 | Practical Training in Measurement of Vibrations | 4 CR | Fidlin |

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

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

**Competence Goal**
The students know different methods which may be applied for the analysis of investigation of vibrations problems. They are able to treat one or multiple degrees of freedom systems as well as vibrating continua. The goal is to establish a chain from physical modeling via mathematical solution to an interpretation of the results. Based on the courses which are chosen the knowledge has emphasis on theoretical investigations, approximation methods or experimental methods and applications in automotive engineering.

**Prerequisites**
none

**Workload**
The work load is about 480 hours, corresponding to 16 credit points. 1 LP = 30 working hours

**Learning type**
Lectures, Tutorials

## 2.60 Module: Master's Thesis [M-MACH-102858]

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

**Part of:** Master Thesis

| Credits | Language | Level | Version |
|---|---|---|---|
| 30 | Deutsch | 4 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105299 | Master's Thesis | 30 CR | Heilmaier |

**Competence Certificate**
The module Master Thesis consists of a written master thesis and an oral presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The master thesis is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

The maximal processing time of the master thesis takes three months. With consent of the examiner the thesis can be written in another language than German as well. The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the master thesis may be only returned once and only within the first month of processing time.

On a reasoned request of the student, the examination board can extend the processing time by up to one month. If the master thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.

The master thesis is to be evaluated by not less than a professor or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITG and another examiner. Generally, one of the two examiners is the person who has assigned the thesis. If the examiners do not agree, the master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master thesis has to be graded within a period of six weeks after the submission.

The colloquium presentation must be held within 6 weeks after the submission of the master thesis. The presentation should last around 30 minutes and is followed by a scientific discussion with the present expert audience.

**Competence Goal**
The student is able to work independently on a defined, subject-relevant theme based on scientific criteria within a given period of time. The student is able to do research independently, to analyze information, to abstract as well as collect and recognize basic principles and regularities on the basis of less structured information. He/she overviews the given scientific question, is able to choose sophisticated scientific methods and techniques, and use them to solve this question and to identify further potentials, respectively. In addition, this will be carried out in consideration of social and/or ethical aspects.

The student can interpret, evaluate, and if needed plot the results obtained in a more sophisticated way. He/she is able to clearly structure his scientific work and (a) to communicate it in written form using state-of-the-art technical terminology as well as (b) to present it in oral form and discuss it with experts.

**Prerequisites**
The requirement for admission to the master thesis module are 74 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

**Modeled Conditions**
The following conditions have to be fulfilled:

1. You need to earn at least 74 credits in the following fields:
    - Advanced Engineering Fundamentals
    - Specialization

**Content**
The student shall be allowed to make suggestions for the topic of his/her master thesis. The topic is set by the supervisor of the thesis in accordance with § 14 (3) SPO.

**Workload**
The workload for the preparation and presentation of the master thesis is about 900 hours.

# M 2.61 Module: Mathematical Methods (MSc-Modul 08, MM) [M-MACH-102594]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 6 | Once | Deutsch/Englisch | 4 | 1 |

| Election block: Mathematische Methoden (1 item) | | | |
|---|---|---|---|
| T-MACH-105293 | Mathematical Methods in Dynamics | 5 CR | Proppe |
| T-MACH-100297 | Mathematical Methods in Strength of Materials | 5 CR | Böhlke |
| T-MACH-105294 | Mathematical Methods of Vibration Theory | 5 CR | Seemann |
| T-MACH-105295 | Mathematical Methods in Fluid Mechanics | 6 CR | Frohnapfel |
| T-MACH-105298 | Mathematical Methods in Structural Mechanics | 6 CR | Böhlke |
| T-MACH-105189 | Mathematical Models and Methods for Production Systems | 6 CR | Furmans, Rimmele |
| T-MATH-102242 | Numerical Mathematics for Students of Computer Science | 6 CR | Rieder, Weiß, Wieners |
| T-MATH-109620 | Probability Theory and Statistics | 6 CR | Hug |
| **Election block: Übungen zu Mathematische Methoden ()** | | | |
| T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | 0 CR | Böhlke |
| T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | 0 CR | Böhlke |

**Competence Certificate**
written exam, duration 3 h

**Competence Goal**
Students will deepen and explain mathematical methods and transfer them to a variety of engineering problems. They are able to select suitable methods and transfer them to new problems.

**Prerequisites**
none

**Content**
see chosen brick course.

**Workload**
The work load is about 180 hours, corresponding to 6 credit points.

**Learning type**
Lectures, Tutorials

# M 2.62 Module: Modeling and Simulation (MSc-Modul 05, MS) [M-MACH-102592]

**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:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 7 | Once | Deutsch/Englisch | 4 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105297 | Modeling and Simulation | 7 CR | Furmans, Geimer, Pritz, Proppe |

**Competence Certificate**
written exam, 3 hours

**Competence Goal**
Students are able to explain models and simulations as part of many disciplines of mechanical engineering. They are able to reproduce the interdisciplinary aspects of typical modeling and simulation techniques in mechanical engineering. The students are proficient in simulation studies from problem formulation to modeling, simulation, verification and validation, ie:

- They are able to formulate the steps necessary to resolve problems arising in engineering, to create appropriate conceptual and mathematical models and to analyze them.

- They are able to develop and implement algorithms for the solution of mathematical models.

- They are able to perform comprehensive and interdisciplinary simulation studies to assess the simulation results and to critically evaluate the quality of the simulation results.

**Prerequisites**
none

**Content**
Introduction: Overview, concept formulation, simulation studies.

Time/event-discrete models, event-orientated/process orientated/transaction orientated 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.

**Workload**
Regular attendance: 42 hours

Self-study: 168 hours

**Learning type**
Lecture and Tutorials

# M 2.63 Module: Product Development - Dimensioning of Components (MSc-Modul 06, PE-B) [M-MACH-102593]

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

**Part of:** Advanced Engineering Fundamentals

| Credits | Recurrence | Language | Level | Version |
|---|---|---|---|---|
| 7 | Once | Deutsch/Englisch | 4 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105383 | Product Development - Dimensioning of Components | 7 CR | Dietrich, Schulze |

**Competence Certificate**
The assessment is carried out as a written exam (2 hours).

**Competence Goal**
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.

**Prerequisites**
none

**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.

**Workload**
The workload for the lecture "Product Development - Dimensioning of Components" is 210 h per semester and consists of the presence during the lectures (50 h) including tutorials, preparation and rework time at home (80 h) and preparation time for the oral exam (80 h).

**Learning type**
Lectures
Tutorials

# M 2.64 Module: Product Development - Methods of Product Development [M-MACH-102718]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Advanced Engineering Fundamentals

| Credits | Language | Level | Version |
|---|---|---|---|
| 6 | Deutsch/Englisch | 4 | 2 |

| Mandatory | | | |
|---|---|---|---|
| T-MACH-109192 | Methods and Processes of PGE - Product Generation Development | 6 CR | Albers, Burkardt, Matthiesen |

**Competence Certificate**
Written examination (processing time: 120 min + 10 min reading time)

**Competence Goal**
The students are able to ...

- classify product development in companies and differentiate between different types of product development.
- name the relevant influencing factors of a market for product development.
- name, compare and use the central methods and process models of product development within moderate complex technical systems.
- explain problem solving techniques and associated development methods.
- explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
- use design guidelines to create simple technical systems and to explain these guidelines.
- name and compare quality assurance methods; to choose and use suitable methods for particular applications.
- explain the differents methods of design of experiment.
- explain the costs in development process.

**Prerequisites**
None

**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

**Workload**
regular attendance: 31.5 h

self-study: 148.5 h

**Learning type**
Lecture

Tutorial

**Literature**
Lecture documents
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag, 1993

# 3 Courses

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

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2189404 | A holistic approach to power plant management | 2 SWS | Lecture (V) | Seidl, Stieglitz |
| WS 18/19 | 2189404 | A holistic approach to power plant management | 2 SWS | Lecture (V) | Seidl |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106698 | A holistic approach to power plant management | | Prüfung (PR) | Stieglitz |

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

**Prerequisites**
none

**Annotation**
none

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

### V A holistic approach to power plant management

2189404, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
Main Contents:

The structure ofelectricity markets

Requirements from network operators

The basics of commodity markets

The impact of regulation on power plant operation

The role of behavioral economics in power plant decision making

Integration of renewable energy sources into the electricity market

Calibration of power plant operation and maintenance to market requirements

Asset management for power plant fleets

Applying financial engineering to optimize asset utilization

Day-to-day decision making for power plant operation

**Learning Content**
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.

**Workload**

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

**Literature**

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

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

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

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

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141866 | Actuators and sensors in nanotechnology | 2 SWS | Lecture (V) | Kohl, Sommer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105238 | Actuators and Sensors in Nanotechnology | | Prüfung (PR) | Kohl, Sommer |
| WS 18/19 | 76-T-MACH-105238 | Actuators and Sensors in Nanotechnology | | Prüfung (PR) | Kohl, Sommer |

**Competence Certificate**
oral exam

**Prerequisites**
none

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

### V Actuators and sensors in nanotechnology
2141866, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
- Physical principles of actuation and sensing
- Scaling and size effects
- Fabrication technologies
- Selected developments
- Applications

The lecture includes amongst others the following topics:

Nano technologies

Nano electro mechanical systems (NEMS)

Nano magneto mechanical and multiferroic systems

Polymer-based nano actuators

Nano motors, molecular systems

Adaptive nano optical systems

Nanosensors: concepts, materials, fabrication

Examples on different categories of materials and applications:

C-based, MeOx-based nano sensors

Physical, chemical, biological nano sensors

Multivariant data analysis / interpretation

**Workload**
time of attendance: 1.5 hours/week

Self-study: 8.5 hours/week

**Literature**

- Lecture notes
- 2. Balzani, V., Credi, A., & Venturi, M., Molecular devices and machines: concepts and perspectives for the nanoworld, 2008
- "Nanowires and Nanobelts, - Materials, Properties and Devices -, Volume 2: Nanowires and Nanobelts of Functional Materials", Edited by Zhong Lin Wang, Springer, 2003, ISBN 10 0-387-28706-X
- "Sensors Based on Nanostructured Materials", Edited by Francisco J. Arregui, Springer, 2009, ISBN: 978-0-387-77752-8
- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

## T 3.3 Course: Advanced Methods in Strength of Materials [T-MACH-100296]

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

**Part of:** M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161252 | Advanced Methods in Strength of Materials | 2 SWS | Lecture (V) | Böhlke, Schneider |
| WS 18/19 | 2161985 | Rechnerübungen zu Höhere Technische Festigkeitslehre | 2 SWS | Practice (Ü) | Gajek |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100296 | Advanced Methods in Strength of Materials | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-100296 | Advanced Methods in Strength of Materials | | Prüfung (PR) | Böhlke |

**Competence Certificate**
Written examination (90 min). Additives as announced

**Prerequisites**
None

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

### V Advanced Methods in Strength of Materials
2161252, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- kinematics
- mechanical balance laws
- theory of elasticity
- linear elastic fracture mechanics
- linear and plane structures
- elasto-plasticity theory

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

**Literature**
lecture notes

Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994.

Gross, D.; Seelig, T.: Bruchmechanik. Springer 2002.

Hibbeler, R.C: Technische Mechanik 2 - Festigkeitslehre. Pearson Studium 2005.

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

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154420 | Aerodynamics | 2 SWS | Block lecture (BV) | Ohle |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105528 | Aerodynamics | | Prüfung (PR) | Frohnapfel |
| WS 18/19 | 76-T-MACH-105528 | Aerodynamics | | Prüfung (PR) | |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

### V Aerodynamics

2154420, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**

Blackboard

**Learning Content**

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

**Annotation**
Block course with limited number of participants, registration in the secretary's office required.

See details at www.istm.kit.edu.

**Workload**
regular atendance: 20h

self studie: 100h

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

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

Schlichting, Gersten. Grenzschichttheorie, Springer

## T 3.5 Course: Aerothermodynamics [T-MACH-105437]

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel
Prof. Dr.-Ing. Friedrich Seiler

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154436 | Aerothermodynamics | 2 SWS | Block lecture (BV) | Seiler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105437 | Aerothermodynamics | | Prüfung (PR) | Seiler |
| WS 18/19 | 76-T-MACH-105437 | Aerothermodynamics | | Prüfung (PR) | |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

### V Aerothermodynamics
2154436, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**

Power Point

**Learning Content**

- Nature of a hypersonic flow
- Fundamentals of aerothermodynamics
- Problems during re-entry
- Flow regimes during re-entry
- Applied hypersonic research

**Annotation**
Block course with limited number of participants, registration in the secretary's office required. See details at www.istm.kit.edu

**Workload**
regular attendance: 21
self-study: 99h

**Literature**
H. Oertel jun.: Aerothermodynamik, Springer-Verlag, Berlin Heidelberg New York,
1994
F. Seiler: Skript zur Vorlesung über Aerothermodynamik

## 3.6 Course: Airport Logistics [T-MACH-105175]

**Responsible:** André Richter
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117056 | Airport logistics | 2 SWS | Lecture (V) | Richter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105175 | Airport Logistics | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105175 | Airport Logistics | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

### Airport logistics
2117056, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

presentations

**Learning Content**
Introduction
airport installations
luggage transport
passenger transport
security on the airport
legal bases of the air traffic
freight on the airport

**Annotation**
Limited number of participants: allocation of places in sequence of application (first come first served)

Application via "ILIAS" mandatory

personal presence during lectures mandatory

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

**Literature**
„Gepäcklogistik auf Flughäfen“ à http://www.springer.com/de/book/9783642328527

## T 3.7 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-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133132 | Alternative Powertrains for Automobiles | 2 SWS | Lecture (V) | Noreikat |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105655 | Alternative Powertrain for Automobiles | | Prüfung (PR) | Noreikat |
| WS 18/19 | 76-T-MACH-105655 | Alternative Powertrain for Automobiles | | Prüfung (PR) | |

**Competence Certificate**
written exam

## T 3.8 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134150 | Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines | 2 SWS | Lecture (V) | Gohl |
| **Exams** | | | | | |
| SS 2018 | 76--T-Mach-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | | Prüfung (PR) | Gohl |
| SS 2018 | 76-T-MACH-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | | Prüfung (PR) | Koch |
| SS 2018 | 76-T-Mach-2134150 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | | Prüfung (PR) | Gohl |
| WS 18/19 | 76-T-MACH-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | | Prüfung (PR) | Koch |

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

**Prerequisites**
none

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

### V Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines
2134150, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture with Powerpoint slides

**Learning Content**
The students get involved in the application of different measurement techniques in the field of exhaust gas and lubricating oil analysis. The functional principles of the systems as well as the application areas of the latter are discussed. In addition to a general overview of standard applications, current specific development and research activities are introduced.

**Workload**
regular attendance: 24 hrs

self study: 96 hrs

**Literature**
The lecture documents are distributed during the courses.

## T 3.9 Course: Analysis Tools for Combustion Diagnostics [T-MACH-105167]

**Responsible:** Jürgen Pfeil
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134134 | Analysis tools for combustion diagnostics | 2 SWS | Lecture (V) | Pfeil |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105167 | Analysis Tools for Combustion Diagnostics | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105167 | Analysis Tools for Combustion Diagnostics | | Prüfung (PR) | Koch |

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

**Prerequisites**
none

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

### V Analysis tools for combustion diagnostics

2134134, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
energy balance at the engine

energy conversion in the combustion chamber

thermodynamics of the combustion process

flow velocities

flame propagation

special measurement techniques

**Workload**
regular attendance: 24 hours
self-study: 96 hours

**Literature**
Lecture notes available in the lectures

## T 3.10 Course: Appliance and Power Tool Design [T-MACH-105229]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2145164 | Appliance and Power Tool Design | 3 SWS | Lecture (V) | Matthiesen |
| SS 2018 | 2145165 | Appliance and Power Tool Design Project Work | 1 SWS | Project (PRO) | Matthiesen, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105229 | Appliance and Power Tool Design | | Prüfung (PR) | Matthiesen |
| WS 18/19 | 76-T-MACH-105229 | Appliance and Power Tool Design | | Prüfung (PR) | Matthiesen |

**Competence Certificate**
Oral examination

**Prerequisites**
The participationin “ Appliance and power tool design”” requires the concurrent project work.
Due to organizational reasons, the number of participants is limited. At the beginning of august, a registration form will be available at the IPEK website. In the case of too many applicants, a selection process will be taking place. An early application is advantageous.

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

### V Appliance and Power Tool Design
2145164, SS 2018, 3 SWS, Open in study portal **Lecture (V)**

**Learning Content**
Operation system, system of objects and system of objectives of mechatronic appliances and power tool designs.

Mode of operation as enabler of design, components of mechatronic systems, application oriented design, guidelines for appliance and power tool design.

Part of the lecture is a project work, in which theory will be reprocessed and presented in a practical way. In such exercises the students also will present their results developed in project teams.

The interaction of analysis and sysnthesis will be acquired in student teams at the example of different appliances and power tools.

**Workload**
regular attendance: 73,5 h

self-study: 148 h

### V Appliance and Power Tool Design Project Work
2145165, SS 2018, 1 SWS, Open in study portal **Project (PRO)**

**Learning Content**
The interaction of analysis and synthesis will be acquired in student teams at the example of different appliances and power tools.

**Workload**
lectures: 42 h
preparation to exam: 18 h

# T 3.11 Course: Application of Advanced Programming Languages in Mechanical Engineering [T-MACH-105390]

**Responsible:** Dr. Daniel Weygand
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182735 | Application of advanced programming languages in mechanical engineering | 2 SWS | Lecture (V) | Weygand |
| SS 2018 | 2182736 | Lab - Application of advanced programming languages in mechanical engineering' | 2 SWS | Practice (Ü) | Weygand |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105390 | Application of Advanced Programming Languages in Mechanical Engineering | | Prüfung (PR) | Weygand |
| WS 18/19 | 76-T-MACH-105390 | Application of Advanced Programming Languages in Mechanical Engineering | | Prüfung (PR) | Weygand |

**Competence Certificate**
oral exam ca. 30 minutes

**Prerequisites**
It is not possible, to combine this brick with brick Scientific computing for Engineers [T-MACH-100532].

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-100532 - Scientific Computing for Engineers must not have been started.

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

## V Application of advanced programming languages in mechanical engineering — Lecture (V)
2182735, SS 2018, 2 SWS, Open in study portal

**Learning Content**
This lecture gives an introduction to advances programming and scripting languages and numerical methods under UNIX/Linux:

* Fortran 95/2003
- structure of source code
- progamming
- compiling
- debugging
- parallelization with OpenMP
* numerical methods
* script languages: Python, awk
* visualisation

**Workload**
regular attendance: 22,5 hours
Lab: 22,5 hours
self-study: 75 hours

**Literature**

1. fortran 95/2003 explained, M. Metcalf, J. Reid, M. Cohen, Oxford University Press 2004.
2. Intel Fortran compiler handbook.

V **Lab - Application of advanced programming languages in mechanical engineering'** **Practice (Ü)**
2182736, SS 2018, 2 SWS, Open in study portal

**Learning Content**
* Working under Unix/Linux:
- login
- organization of files
- file system
- shell commands
- administration of jobs
- editor

* visualisation of data unter Linux

programming exercises

**Workload**
see lecture

**Literature**
siehe Vorlesung

## T 3.12 Course: Applied Materials Modelling [T-MACH-105527]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 7 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182614 | Applied Materials Modelling | 4 SWS | Lecture / Practice (VÜ) | Schulz, Gumbsch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105527 | Applied Materials Modelling | | Prüfung (PR) | Gumbsch, Schulz |
| WS 18/19 | 76-T-MACH-105527 | Applied Materials Modelling | | Prüfung (PR) | Gumbsch, Schulz |

**Competence Certificate**
oral exam

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

### V Applied Materials Modelling
2182614, SS 2018, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

black board, beamer, script, computer exercise

**Learning 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.

**Workload**
regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

**Literature**

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

## T 3.13 Course: Applied Mathematics in Natural Science: Flows with chemical reactions [T-MACH-108847]

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

**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153406 | Flows with chemical reactions | 2 SWS | Lecture (V) | Class |

**Competence Certificate**
The study performance is considered to have been passed if all exercise assignments have been successfull processed and the final colloquium (30 minutes) has been successfully passed.

no auxiliary mean

**Prerequisites**
none

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

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

### V Flows with chemical reactions
2153406, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
Black board

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

**Workload**
regulare attendance: 22.5h

self-study: 99h

**Literature**
Lecture

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

## T 3.14 Course: Applied Tribology in Industrial Product Development [T-MACH-105215]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Benoit Lorentz

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2145181 | Applied Tribology in Industrial Product Development | 2 SWS | Lecture (V) | Lorentz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105215 | Applied Tribology in Industrial Product Development | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105215 | Applied Tribology in Industrial Product Development | | Prüfung (PR) | Albers |

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

**Prerequisites**
None

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

### V Applied Tribology in Industrial Product Development — Lecture (V)
2145181, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
Friction, Wear, Wear Measurement

Lubricant (Oil, Grease, etc.)

Hydrodynamic and elastohydrodynamic Lubrication

Design of Tribologic Working Surface Pairs

Technique of Measurement in Lubricated Contacts

Prevention of Maschine Failure

Protective Surface Layers

Journal Bearings, Roller Bearings

Gear Wheels and Transmissions

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**
The lecture script will be allocated at Ilias.

# T 3.15 Course: Atomistic Simulations and Molecular Dynamics [T-MACH-105308]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102637 - Schwerpunkt: Tribologie
M-MACH-102649 - Schwerpunkt: Advanced Materials Modelling
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2181740 | Atomistic simulations and molecular dynamics | 2 SWS | Lecture (V) | Brandl, Gumbsch |
| SS 2018 | 2181741 | Lab for 'Atomistic simulations and molecular dynamics' | 2 SWS | Practice (Ü) | Brandl, Gumbsch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | | Prüfung (PR) | Gumbsch |
| WS 18/19 | 76-T-MACH-105308 | Atomistic Simulations and Molecular Dynamics | | Prüfung (PR) | Gumbsch |

**Competence Certificate**
oral exam ca. 30 minutes

**Prerequisites**
none

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

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

## V Atomistic simulations and molecular dynamics

2181740, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Notes**
Lecture in English!

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

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

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

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

**Literature**

1. Understanding Molecular Simulation: From Algorithms to Applications, Daan Frenkel and Berend Smit (Academic Press, 2001)
2. Computer simulation of liquids, M. P. Allen and Dominic J. Tildesley (Clarendon Press, Oxford, 1996)

V **Lab for 'Atomistic simulations and molecular dynamics'** **Practice (Ü)**
2181741, SS 2018, 2 SWS, Open in study portal

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

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

**Workload**
see lecture

**Literature**
see lecture

## T 3.16 Course: Automated Manufacturing Systems [T-MACH-108844]

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

**Part of:**
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150904 | Automated Manufacturing Systems | 6 SWS | Lecture / Practice (VÜ) | Fleischer |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108844 | Automated Manufacturing Systems | | Prüfung (PR) | Fleischer |

**Competence Certificate**
oral exam (40 minutes)

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

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-102162 - Automated Manufacturing Systems must not have been started.

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

### V Automated Manufacturing Systems
2150904, SS 2018, 6 SWS, Open in study portal

**Lecture / Practice (VÜ)**

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

**Learning 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.

**Annotation**
None

**Workload**
**MACH:**
regular attendance: 63 hours
self-study: 177 hours
**WING/TVWL:**
regular attendance: 63 hours
self-study: 207 hours

**Literature**
Lecture Notes

## T 3.17 Course: Automated Manufacturing Systems [T-MACH-102162]

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

**Part of:** M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 9 | Each summer term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150904 | Automated Manufacturing Systems | 6 SWS | Lecture / Practice (VÜ) | Fleischer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102162 | Automated Manufacturing Systems | | Prüfung (PR) | Fleischer |
| SS 2018 | 76-T-MACH-102162-MIT | Automated Manufacturing Systems | | Prüfung (PR) | Fleischer |
| WS 18/19 | 76-T-MACH-102162 | Automated Manufacturing Systems | | Prüfung (PR) | Fleischer |
| WS 18/19 | 76-T-MACH-102162-MIT | Automated Manufacturing Systems | | Prüfung (PR) | Fleischer |

**Competence Certificate**
written exam (120 minutes)

**Prerequisites**
"T-MACH-108844 - Automatisierte Produktionsanlagen" must not be commenced.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-108844 - Automated Manufacturing Systems must not have been started.

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

### V Automated Manufacturing Systems
2150904, SS 2018, 6 SWS, Open in study portal

**Lecture / Practice (VÜ)**

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

**Learning 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.

**Annotation**
None

**Workload**
**MACH:**
regular attendance: 63 hours
self-study: 177 hours
**WING/TVWL:**
regular attendance: 63 hours
self-study: 207 hours

**Literature**
Lecture Notes

## T 3.18 Course: Automation Systems [T-MACH-105217]

**Responsible:** Prof. Dr.-Ing. Michael Kaufmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2106005 | Automation Systems | 2 SWS | Lecture (V) | Kaufmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105217 | Automation Systems | | Prüfung (PR) | Kaufmann, Hagenmeyer |
| WS 18/19 | 76-T-MACH-105217 | Automation Systems | | Prüfung (PR) | Kaufmann, Hagenmeyer |

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

**Prerequisites**
none

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

### V Automation Systems

2106005, SS 2018, 2 SWS, Open in study portal **Lecture (V)**

**Learning Content**

- Introduction: Terms and definitions, examples, requirements
- Industrial processes: classification, process conditions
- Automation tasks
- Components of industrial automation systems: control functions, data acquisition, data output equipment, Programmable Logic Controllers, PC-based control
- Industrial communication, classification, topology, protocols, bus systems for automation systems
- Engineering: plant engineering, composition of control systems, programming
- Requirements on equipment, documentation, identification
- Dependability and safety
- Diagnosis
- Application examples

**Workload**
general attendance: 21 h

self-study: 99 h

**Literature**

- Gevatter, H.-J., Grünhaupt, U.: Handbuch der Mess- und Regelungstechnik in der Produktion. 2. Auflage, Berlin, Heidelberg: Springer-Verlag, 2006.
- Langmann, R.: Taschenbuch der Automatisierung. München: Fachbuchverlag Leipzig, 2010.
- Strohrmann, G.: Automatisierung verfahrenstechnischer Prozesse: eine Einführung für Ingenieure und Techniker. München, Wien: Oldenbourg-Industrieverlag, 2002.
- Wellenreuther, G., Zastrow, D.: Automatisieren mit SPS: Theorie und Praxis. 4. Auflage, Wiesbaden: Vieweg+Teubner, 2009.

## T 3.19 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-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Expansion | Language | Version |
|---|---|---|---|---|---|
| Prüfungsleistung schriftlich | 8 | Each winter term | 1 terms | | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113805 | Automotive Engineering I | 4 SWS | Lecture (V) | Gauterin, Unrau |
| WS 18/19 | 2113809 | Automotive Engineering I | 4 SWS | Lecture (V) | Gauterin, Gießler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100092 | Automotive Engineering | | Prüfung (PR) | Gauterin, Unrau |
| WS 18/19 | 76-T-MACH-100092 | Automotive Engineering | | Prüfung (PR) | Unrau, Gauterin |

**Competence Certificate**
Written examination

Duration: 120 minutes

Auxiliary means: none

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

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

### V Automotive Engineering I

2113805, WS 18/19, 4 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 45 hours
self-study: 195 hours

**Literature**

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

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

3. Gauterin, F. / Unrau, H.-J. / Gnadler, R.: Script to the lecture 'Grundlagen der Fahrzeugtechnik I', KIT, Institute of Vehicle System Technology, Karlsruhe, annual update

## V Automotive Engineering I

2113809, WS 18/19, 4 SWS, Open in study portal

**Lecture (V)**

**Notes**

In English language.

**Learning Content**

1. History and future of the automobile

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

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

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

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

**Workload**

regular attendance: 45 hours
self-study: 195 hours

**Literature**

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

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

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

4. Gauterin, F. / Gießler, M. / Gnadler, R.: Script to the lecture 'Automotive Engineering I', KIT, Institute of Vehicle System Technology, Karlsruhe, annual update

## T 3.20 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114835 | Automotive Engineering II | 2 SWS | Lecture (V) | Unrau |
| SS 2018 | 2114855 | Automotive Engineering II | 2 SWS | Lecture (V) | Gießler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102117 | Automotive Engineering II | | Prüfung (PR) | Unrau, Gauterin |
| WS 18/19 | 76-T-MACH-102117 | Automotive Engineering II | | Prüfung (PR) | Unrau, Gauterin |
| WS 18/19 | 76T-MACH-102117-2 | Automotive Engineering II | | Prüfung (PR) | Gauterin, Unrau |

**Competence Certificate**
Written Examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Automotive Engineering II

2114835, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

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

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

3. Gnadler, R. / Unrau, H.-J.: Script to the lecture 'Grundlagen der Fahrzeugtechnik II'

V

## Automotive Engineering II

2114855, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Steering elements of single vehicles and of trailers
3. Brakes: Disc brake, drum brake, retarder, comparison of the designs

**Literature**
**Elective literature:**


1. Reimpell, J.: Fahrwerktechnik: Grundlagen, Vogel Verlag, 1995
2. Burckhardt, M.: Bremsdynamik und Pkw-Bremsanlagen, Vogel Verlag, 1991
3. Gnadler, R.: Skript zur Vorlesung "Grundlagen der Fahrzeugtechnik II"

## T 3.21 Course: Automotive Logistics [T-MACH-105165]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118085 | Automotive Logistics | 2 SWS | Lecture (V) | Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105165 | Automotive Logistics | | Prüfung (PR) | Mittwollen, Furmans |
| WS 18/19 | 76-T-MACH-105165 | Automotive Logistics | | Prüfung (PR) | Furmans, Mittwollen |

**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 Automotive Logistics

2118085, SS 2018, 2 SWS, Open in study portal **Lecture (V)**

**Description**
**Media:**
presentations, black board

**Learning Content**

- Logistic questions within the automobile industry
- basic model of automobile production and distribution
- relation with the suppliers
- Disposition and physical execution
- Vehicle production in the interaction of shell, paint shop and assembly
- Sequence planning
- Assembly supply
- vehicle distribution and linkage with selling processes
- Physical execution, planning and control

**Annotation**
none

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

**Literature**
None.

## T 3.22 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2138340 | Automotive Vision | 3 SWS | Lecture (V) | Lauer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105218 | Automotive Vision | | Prüfung (PR) | Stiller, Lauer |
| WS 18/19 | 76-T-MACH-105218 | Automotive Vision | | Prüfung (PR) | Stiller, Lauer |

### Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

### Prerequisites
none

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

## V Automotive Vision
2138340, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

### Learning Content
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

### Workload
120 hours

### Literature
TBA

## T 3.23 Course: Basics of Technical Logistics [T-MACH-102163]

**Responsible:** Dr.-Ing. Martin Mittwollen
Jan Oellerich

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117095 | Basics of Technical Logistics | 4 SWS | Lecture / Practice (VÜ) | Mittwollen, Oellerich |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102163 | Basics of Technical Logistics | | Prüfung (PR) | Mittwollen |
| WS 18/19 | 76-T-MACH-102163 | Basics of Technical Logistics | | Prüfung (PR) | Mittwollen |

### Competence Certificate
The assessment consists of a written exam (90 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

### Prerequisites
none

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

## V Basics of Technical Logistics
2117095, WS 18/19, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

### Description
**Media:**

supplementary sheets,presentations, blackboard

### Notes
lectures and practice; practice dates: look up ILIAS

**Learning 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

**Annotation**
Basics knowledge of technical mechanics is preconditioned

**Workload**
presence: 48h

rework: 132h

**Literature**
Recommendations during lessons

## T 3.24 Course: Behaviour Generation for Vehicles [T-MACH-105367]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller
Dr. Moritz Werling

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2138336 | Behaviour Generation for Vehicles | 2 SWS | Lecture (V) | Werling, Stiller |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105367 | Behaviour Generation for Vehicles | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105367 | Behaviour Generation for Vehicles | | Prüfung (PR) | Stiller |

**Competence Certificate**
written examination

60 min.

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

**Prerequisites**
none

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

### V Behaviour Generation for Vehicles

2138336, SS 2018, 2 SWS, Open in study portal **Lecture (V)**

**Learning Content**
1. Driver assistance systems
2. Driving comfort and safety
3. Vehicle dynamics
4. Path and trajectory planning
5. Path control
6. Collision avoidance

**Workload**
120 hours

**Literature**
TBA

## T 3.25 Course: Bioelectric Signals [T-ETIT-101956]

**Responsible:** Dr.-Ing. Axel Loewe
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2305264 | Bioelectric Signals | 2 SWS | Lecture (V) | Loewe, Seemann |
| **Exams** | | | | | |
| SS 2018 | 7305264 | Bioelectric Signals | | Prüfung (PR) | Seemann |
| WS 18/19 | 7305264 | Bioelectric Signals | | Prüfung (PR) | Loewe |

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

## T 3.26 Course: Biomechanics: design in nature and inspired by nature [T-MACH-105651]

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

**Part of:** M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181708 | Biomechanics: Design in Nature and Inspired by Nature | 3 SWS | Seminar / Practical course (S/P) | Mattheck |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105651 | Biomechanics: design in nature and inspired by nature | | Prüfung (PR) | Schwarz |
| WS 18/19 | 76-T-MACH-105651 | Biomechanics: design in nature and inspired by nature | | Prüfung (PR) | Mattheck |

**Competence Certificate**
Colloquium, ungraded.

**Prerequisites**
The number of participants is limited. Prior registration through ILIAS is necessary, In case of too many registrations, a selection (in accordance with SPO) will take place.
Before the registration in SP 26 (ME) or SP 01 (MSMT) the participation at the seminar must be confirmed.

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

### V Biomechanics: Design in Nature and Inspired by Nature
2181708, WS 18/19, 3 SWS, Open in study portal

**Seminar / Practical course (S/P)**

**Notes**
22.10.2018: Biomechanics is already fully booked in WS 18/19, further registrations are not possible

The number of participants is limited.

**Learning Content**
* mechanics and growth laws of trees
* failure criteria and safety factors
* computer simulation of adaptive growth
* notches and damage case studies
* optimization inspired by nature
* structural shape optimization without computers
* universal shapes of nature
* fibre reinforces materials
* failure of trees, hillsides, dikes, walls and pipes

**Workload**
regular attendance: 30 hours
self-study: 90 hours

## 3.27 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-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2305269 | Biomedizinische Messtechnik I | 2 SWS | Lecture (V) | Nahm |
| **Exams** | | | | | |
| SS 2018 | 7305269 | Biomedical Measurement Techniques I | | Prüfung (PR) | Nahm |
| WS 18/19 | 7305269 | Biomedical Measurement Techniques I | | Prüfung (PR) | Nahm |

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

### Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-ETIT-101928 - Biomedical Measurement Techniques I must not have been started.

## 3.28 Course: Biomedical Measurement Techniques II [T-ETIT-106973]

**Responsible:** Prof. Dr. Werner Nahm
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2305270 | Biomedical Measurement Techniques II | 2 SWS | Lecture (V) | Nahm |
| **Exams** | | | | | |
| SS 2018 | 7305270 | Biomedical Measurement Techniques II | | Prüfung (PR) | Nahm |
| WS 18/19 | 7305270 | Biomedical Measurement Techniques II | | Prüfung (PR) | Nahm |

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

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141864 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 2 SWS | Lecture (V) | Guber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | | Prüfung (PR) | Guber |
| WS 18/19 | 76-T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | | Prüfung (PR) | Guber |

**Competence Certificate**
written exam (75 Min.)

**Prerequisites**
none

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

### BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I
2141864, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture script

**Learning Content**
Introduction into various microtechnical manufacturing methods: LIGA, Micro milling, Silicon Micromachining, Laser Microstructuring, µEDM, Metal-Etching
Biomaterials, Sterilisation.
Examples of use in the life science sector: basic micro fluidic strucutures: micro channels, micro filters, micromixers, micropumps, microvalves, Micro and nanotiter plates, Microanalysis systems (µTAS),
Lab-on-chip applications.

**Annotation**
The exam is held during the semester break. The date will be announced at the beginning of the semester.

**Workload**
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

**Literature**

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

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

## T 3.30 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142883 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 2 SWS | Lecture (V) | Guber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | | Prüfung (PR) | Guber |
| WS 18/19 | 76-T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | | Prüfung (PR) | Guber |

**Competence Certificate**
Written exam (75 Min.)

**Prerequisites**
none

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

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

2142883, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture script

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

**Workload**
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

**Literature**

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

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

M. Madou
Fundamentals of Microfabrication

## T 3.31 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III [T-MACH-100968]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142879 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 2 SWS | Lecture (V) | Guber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | | Prüfung (PR) | Guber |
| WS 18/19 | 76-T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | | Prüfung (PR) | Guber |

**Competence Certificate**
Written exam (75 Min.)

**Prerequisites**
none

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

### V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III

2142879, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture script

**Learning 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

**Workload**
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

**Literature**

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

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

M. Madou
Fundamentals of Microfabrication

## T 3.32 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine IV [T-MACH-106877]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141102 | BioMEMS IV - Microsystems technology for Life Sciences and Medicine | 2 SWS | Lecture (V) | Guber, Ahrens, Doll, Länge, Rajabi, Finkbeiner |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106877 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine IV | | Prüfung (PR) | Guber |

**Competence Certificate**
Oral examination (45 Min.)

**Prerequisites**
none

## T 3.33 Course: Bionic Inspired Reinforced Composites [T-MACH-106723]

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

**Part of:** M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2126811 | Bionic Inspired Reinforced Composites | 2 SWS | Lecture (V) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-106723 | Bionic Inspired Reinforced Composites | | Prüfung (PR) | Koch |
| SS 2018 | 76-T-MACH-106723 | Bionic Inspired Reinforced Composites | | Prüfung (PR) | |
| WS 18/19 | 76-T-MACH-106723 | Bionic Inspired Reinforced Composites | | Prüfung (PR) | |

**Competence Certificate**
oral exam

## T 3.34 Course: Bionics for Engineers and Natural Scientists [T-MACH-102172]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142140 | Bionics for Engineers and Natural Scientists | 2 SWS | Lecture (V) | Hölscher, Walheim, Greiner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102172 | Bionics for Engineers and Natural Scientists | | Prüfung (PR) | Hölscher |
| WS 18/19 | 76-T-MACH-102172 | Bionics for Engineers and Natural Scientists | | Prüfung (PR) | Hölscher |

**Competence Certificate**
written or oral exam

**Prerequisites**
none

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

### V Bionics for Engineers and Natural Scientists
2142140, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Slides of the lectures

**Learning 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.

**Workload**
lectures 30 h

self study 30 h

preparation for examination 30 h

**Literature**
Werner Nachtigall: Bionik – Grundlagen und Beispiele für Ingenieure und Naturwissenschaftler. Springer-Verlag Berlin (2002), 2. Aufl.

## T 3.35 Course: Boosting of Combustion Engines [T-MACH-105649]

**Responsible:** Dr.-Ing. Johannes Kech
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2134153 | Boosting of Combustion Engines | 2 SWS | Block lecture (BV) | Kech |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105649 | Boosting of Combustion Engines | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105649 | Boosting of Combustion Engines | | Prüfung (PR) | Koch |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

## T 3.36 Course: BUS-Controls [T-MACH-102150]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114092 | BUS-Controls | 2 SWS | Lecture (V) | Geimer, Daiß, Becker |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-102150 | BUS-Controls | | Prüfung (PR) | Geimer |
| SS 2018 | 76-T-MACH-102150 | BUS-Controls | | Prüfung (PR) | Geimer |
| WS 18/19 | 76T-MACH-102150 | BUS-Controls | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-102150 | BUS-Controls | | Prüfung (PR) | Geimer |

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

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

**Modeled Conditions**
The following conditions have to be fulfilled:

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

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

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

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

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

**Content:**

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

**Literature:**

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

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

V **BUS-Controls** **Lecture (V)**
2114092, SS 2018, 2 SWS, Open in study portal

**Learning 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)

**Annotation**
The course will be replenished by interesting lectures of professionals.

**Workload**

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

**Literature**
**Elective literature:**

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

## T 3.37 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108889 | BUS-Controls - Advance | Prüfung (PR) | Geimer |

**Competence Certificate**
Creation of control program

**Prerequisites**
none

## T 3.38 Course: Business Administration for Engineers and IT professionals [T-MACH-109933]

**Responsible:** Dipl.-Ing. Thomas Maier
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

**Competence Certificate**
Assessment of another type. Two presentations and six written compositions in team work. Grading: each composition 1/8 and each presentation 1/8.

**Prerequisites**
None

## T 3.39 Course: Business Planning [T-WIWI-102865]

**Responsible:** Prof. Dr. Orestis Terzidis
**Organisation:** KIT Department of Economics and Management
**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2545005 | Geschäftsplanung für Gründer (Track 1) | 2 SWS | Seminar (S) | Terzidis, Henn |
| SS 2018 | 2545006 | Geschäftsplanung für Gründer (Track 2) | 2 SWS | Seminar (S) | Terzidis, Mitarbeiter |
| WS 18/19 | 2545005 | Geschäftsplanung für Gründer (Track 1) | 2 SWS | Seminar (S) | Terzidis, Lau, Henn |
| WS 18/19 | 2545007 | Business Planning for Founders (ENTECH) | 2 SWS | Seminar (S) | Wohlfeil, Bauman, Terzidis |
| **Exams** | | | | | |
| SS 2018 | 7900054 | Business Planning | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900023 | Business Planning for Founders | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900083 | Business Planning | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900090 | Geschäftsplanung für Gründer (Track 2) | | Prüfung (PR) | Terzidis |

**Competence Certificate**
Non exam assessment (§4 (2), 3 SPO 2007) respectively alternative exam assessments (§4(2), 3 SPO 2015).

**Prerequisites**
None

**Recommendation**
None

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

### V Geschäftsplanung für Gründer (Track 1)
2545005, SS 2018, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
This seminar introduces basic concepts of business planning for entrepreneurs to the participants. It focusses on practical concepts andhands-on-methods on how to turn business ideas into solid businesses (e.g. Business Modelling, Market Potential, Planning of Ressorces, and further more) and on the creation of a realistic and viable Business Plan (with or without Venture Capital)

### V Geschäftsplanung für Gründer (Track 1)
2545005, WS 18/19, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
This seminar introduces basic concepts of business planning for entrepreneurs to the participants. It focusses on practical concepts andhands-on-methods on how to turn business ideas into solid businesses (e.g. Business Modelling, Market Potential, Planning of Ressorces, and further more) and on the creation of a realistic and viable Business Plan (with or without Venture Capital)

**Annotation**
Please register on the seminar website.

WARNING: creditability in Seminar Module

The EnTechnon seminars are NOT accepted in the seminar module! The credit is only possible in MODULE ENTREPRENEURSHIP. OneException is the seminar "Entrepreneurship Research".

# T 3.40 Course: CAD-NX Training Course [T-MACH-102187]

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

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung praktisch | 2 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123357 | CAD-NX training course | 3 SWS | Practical course (P) | Ovtcharova, Mitarbeiter |
| WS 18/19 | 2123357 | CAD-NX training course | 2 SWS | Practical course (P) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102187 | CAD-NX Training Course | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102187 | CAD-NX Training Course | | Prüfung (PR) | Ovtcharova |

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

**Prerequisites**
None

**Recommendation**
Dealing with technical drawings is required.

**Annotation**
For the practical course compulsory attendance exists.

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

## V CAD-NX training course
2123357, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
The participant will learn the following knowledge:

- 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

**Annotation**
For the practical course compulsory attendance exists.

**Workload**
Regular attendance: 35 hours,
Self-study: 12 hours

**Literature**
Practical course skript

V

## CAD-NX training course

2123357, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
The participant will learn the following knowledge:

- 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

**Annotation**
For the practical course compulsory attendance exists.

**Workload**
Regular attendance: 35 hours,
Self-study: 12 hours

**Literature**
Practical course skript

## T 3.41 Course: CAE-Workshop [T-MACH-105212]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2147175 | CAE-Workshop | 3 SWS | Block (B) | Albers, Mitarbeiter |
| WS 18/19 | 2147175 | CAE-Workshop | 3 SWS | Block lecture (BV) | Albers, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105212 | CAE-Workshop | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105212 | CAE-Workshop | | Prüfung (PR) | Albers |

### Competence Certificate
Depending on the manner in which the CAE-Workshop will be credited.
optional compulsory subject: written-practical exam, duration 60 min

optional subject: written-practical exam, duration 45 min

complementary subject as part of the major field: written-practical exam, duration 45 min

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

## V CAE-Workshop

2147175, SS 2018, 3 SWS, Open in study portal

**Block (B)**

### Learning Content
Content in the summer semester:

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

Content in the winter semester:

- 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 multi-body simulation (MBS)
- preparation and running of multi-body simulation models. Coupling of the MBS and FEA to calculate hyprid multi-body simulation problems.

**Workload**
regular attendance: 31.5 h

self-study: 58 h

independent work with different software tools (supported by tutors and faculty stuff)

discussing and presenting results in small groups

**Literature**
The workshop script will be allocated at Ilias.

V **CAE-Workshop**
2147175, WS 18/19, 3 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**
Content in the summer semester:

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

Content in the winter semester:

- 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 multi-body simulation (MBS)
- preparation and running of multi-body simulation models. Coupling of the MBS and FEA to calculate hypрid multi-body simulation problems.

**Workload**
regular attendance: 31.5 h

self-study: 58 h

independent work with different software tools (supported by tutors and faculty stuff)

discussing and presenting results in small groups

**Literature**
The workshop script will be allocated at Ilias.

## T 3.42 Course: CATIA Advanced [T-MACH-105312]

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

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123380 | CATIA advanced | 3 SWS | Others (sonst.) | Ovtcharova, Mitarbeiter |
| WS 18/19 | 2123380 | CATIA für Fortgeschrittene | 3 SWS | Project (PRO) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105312 | CATIA Advanced | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-105312 | CATIA Advanced | | Prüfung (PR) | Ovtcharova |

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

**Prerequisites**
none

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

### V CATIA advanced
2123380, SS 2018, 3 SWS, Open in study portal

**Others (sonst.)**

**Learning Content**

- Use of advanced CAD techniques and CATIA functionalities
- Management of data using the PLM system SmarTeam
- Design engineering with CAD
- Integration of partial solutions into the overall solution
- Ensuring the reusability of CAD models through parameterization and cataloging
- Validation, strength tests (FEM analysis)
- Kinematic simulation with the digital mockup (DMU Kinematics)
- Production with integrated CAM tool
- Animations
- Presentation of results at the end of the semester

**Annotation**
For the workshop compulsory attendance exists.

**Workload**
regular attendance: 21 hours, self-study: 35 hours

## T 3.43 Course: Ceramic Matrix Composites [T-MACH-106722]

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

**Part of:** M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2126810 | Ceramic Matrix Composites | 2 SWS | Lecture (V) | Koch |
| **Exams** | | | | | |
| WS 18/19 | 7600023 | Ceramic Matrix Composites | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-106722 | Ceramic Matrix Composites | | Prüfung (PR) | Koch |

**Competence Certificate**
oral exam

## T 3.44 Course: Ceramic Processing Technology [T-MACH-102182]

**Responsible:** Dr. Joachim Binder
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2126730 | Ceramics Processing | 2 SWS | Lecture (V) | Binder |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102182 | Ceramic Processing Technology | | Prüfung (PR) | |
| WS 18/19 | 76-T-MACH-102182 | Ceramic Processing Technology | | Prüfung (PR) | Wagner |

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

Auxiliary means: none

The re-examination is offered upon agreement.

**Prerequisites**
none

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

### V Ceramics Processing
2126730, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The course imparts technological basics for processing of engineering ceramics. The course is arranged in the following units:

- Synthesis methods
- Powder conditioning and mixing methods
- Forming of ceramics
- Sintering
- Finishing processes
- Ceramic films and multi-layer systems
- Effects of processing on properties

**Workload**
regular attendance: 21 hours

self-study: 99 hours

**Literature**
W. Kollenberg: Technische Keramik, Vulkan Verlag 2010.

M. N. Rahaman: Ceramic Processing, CRC Taylor & Francis, 2007.

D.W. Richerson: Modern ceramic engineering, CRC Taylor & Francis, 2006.

A. G. King: Ceramic Technology and Processing, William Andrew, 2002.

# T 3.45 Course: CFD in Power Engineering [T-MACH-105407]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2130910 | CFD for Power Engineering | 2 SWS | Lecture (V) | Otic |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105407 | CFD in Power Engineering | | Prüfung (PR) | Otic |
| WS 18/19 | 76-T-MACH-105407 | CFD in Power Engineering | | Prüfung (PR) | Otic |

**Competence Certificate**
Oral exam, 30 min

**Prerequisites**
none

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

## V CFD for Power Engineering

2130910, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Notes**
This course is specified for both Bachelor and Master students, Power and Nuclear Engineering.
The course is aimed of giving the fundamental of Computational Fluid Dynamics (CFD) for energy technologies. Starting from the basic physical phenomena equations an overview on computational methods and turbulence modeling is given.

The course consists of both, a theoretical and a numerical component.

The former will deal with the derivations and properties of the methods and models for CFD. The numerical part will make use of a CFD-code 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.

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

**Workload**

- regular attendance: 20 h
- tutorials: 20 h
- self-study: 80 h

**Literature**
Course note packet

Project package

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

## T 3.46 Course: CFD-Lab Using Open Foam [T-MACH-105313]

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

**Part of:** M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2169459 | CFD-Lab using Open Foam | 3 SWS | Practical course (P) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105313 | CFD-Lab Using Open Foam | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105313 | CFD-Lab Using Open Foam | | Prüfung (PR) | Koch |

**Competence Certificate**
Successful solution of problems

**Prerequisites**
none

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

### V CFD-Lab using Open Foam

2169459, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Description**
**Media:**

- A CD containing the course material will be handed out to the students

**Learning Content**

- 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

**Annotation**

- Number of participants is limited
- Priority for students of the lecture "Numerische Simulation reagierender Zweiphasenströmungen" (Vorl.-Nr. 2169458)

**Workload**

- 5 days of 8 h = 40 h

**Literature**

- Documentation of Open Foam
- www.open foam.com/docs

## T 3.47 Course: Coal Fired Power Plants [T-MACH-105410]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169461 | Coal fired power plants | 2 SWS | Lecture (V) | Schulenberg |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105410 | Coal Fired Power Plants | | Prüfung (PR) | Schulenberg |
| WS 18/19 | 76-T-MACH-105410 | Coal Fired Power Plants | | Prüfung (PR) | Schulenberg |

**Competence Certificate**
Oral examination, Duration approximately 30 Minutes

no tools or reference materials may be used during the exam

**Prerequisites**
none

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

### V Coal fired power plants
2169461, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

power point presentation for download from the ILIAS server

**Learning Content**
The lecture presents the technology of coal fired power plants, which are conventional steam turbine plants as well as advanced combined cycle power plants with integrated coal gasification. It includes combustion systems, steam generators, a short overview over steam turbine technologies, the cooling system and the water supply system as well as the off gas treatment. Coal gasification will be explained with fixed bed, fluidized bed and entrained flow gasifiers. The integrated coal gasification combined cycle includes also the raw gas purification system. In addition, a visit to a coal fired power plant will be offered.

**Annotation**
Recommendations: Knowledge in thermodynamics, heat and mass transfer, instrumentation and control, and turbomachines is presumed.

**Workload**
regular attendance: 27 h
self-study: 93 h

**Literature**
Lecture notes (Vorlesungsskript) for download from the ILIAS Server

Everett B. Woodruff, Herbert B. Lammers, Thomas F. Lammers, Steam Plant Operation, 9th Edition, McGraw Hill, New York 2012

## T 3.48 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-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2138341 | Cogitive Automobiles - Laboratory | 3 SWS | Practice (PÜ) | Stiller, Lauer, Wirges |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105378 | Cognitive Automobiles - Laboratory | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105378 | Cognitive Automobiles - Laboratory | | Prüfung (PR) | Stiller, Lauer |

**Competence Certificate**
oral exam

30 minutes

**Prerequisites**
none

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

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

### V Cogitive Automobiles - Laboratory
2138341, SS 2018, 3 SWS, Open in study portal

**Practice (PÜ)**

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

**Workload**
120 hours

**Literature**
TBA

## T 3.49 Course: Cognitive Systems [T-INFO-101356]

**Responsible:** Prof. Dr.-Ing. Rüdiger Dillmann
Prof. Dr. Alexander Waibel

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24572 | Kognitive Systeme | 4 SWS | Lecture / Practice (VÜ) | Dillmann, Waibel, Stüker, Nguyen |
| **Exams** | | | | | |
| SS 2018 | 7500157 | Cognitive Systems | | Prüfung (PR) | Dillmann, Waibel |
| WS 18/19 | 7500332 | Cognitive Systems examination | | Prüfung (PR) | Waibel, Dillmann |

## T 3.50 Course: Combined Cycle Power Plants [T-MACH-105444]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2170490 | Combined Cycle Power Plants | 2 SWS | Lecture (V) | Schulenberg |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105444 | Combined Cycle Power Plants | | Prüfung (PR) | Schulenberg |
| WS 18/19 | 76-T-MACH-105444 | Combined Cycle Power Plants | | Prüfung (PR) | Schulenberg |

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

**Prerequisites**
none

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

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

### V Combined Cycle Power Plants

2170490, SS 2018, 2 SWS, Open in study portal **Lecture (V)**

**Description**
**Media:**

Lecture with English Power Point Presentation

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

**Annotation**
Recommendations: Knowlegde in thermodynamics, heat and mass transfer, instrumentation and control, and turbomachines is presumed.

We recommend to combine the lecture with the Simulator Exercises for Combined Cycle Power Plants (2170491)

**Workload**
Regular attendance: 32 hours

Self study: 88 hours

**Literature**
Power point slides and other lecture material will be provided.

Recommended additional literature:

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

## T 3.51 Course: Combustion Diagnositics [T-MACH-105429]

**Responsible:** Prof. Dr. Ulrich Maas
Dr.-Ing. Robert Schießl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2167048 | Combustion diagnositics | 2 SWS | Lecture (V) | Schießl |
| WS 18/19 | 2167048 | Combustion diagnositics | 2 SWS | Lecture (V) | Schießl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105429 | Combustion Diagnositics | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105429 | Combustion Diagnositics | | Prüfung (PR) | Maas |

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

**Prerequisites**
none

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

### V Combustion diagnositics
2167048, SS 2018, 2 SWS, Open in study portal — **Lecture (V)**

**Learning Content**
Diagnostical methods: Laser induced fluorescence, Rayleigh-scattering, Raman-scattering
Chemoluminescence.
Reduced description of combustion processes and measurements.
Discussion of the potential and limits of specific strategies in different combustion systems.

**Workload**
Regular attendance: 22 hours

Self-study, exam preparation: 100,0 hours

**Literature**
Lecture notes

A.C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, Abacus Press, 2nd ed. (1996)

W. Demtröder, Laser Spectroscopy: Basic Concepts and Instrumentation, Springer, 3rd ed., 2003

Hollas J.M. Modern Spectroscopy, Wiley, 3rd ed., 1996
K. Kohse-Höinghaus, J. B. Jeffries (ed.), Applied Combustion Diagnostics, Taylor and Francis

Atkins P., Paula, J., Physical Chemistry, 8th ed., Oxford University Press, 2006

### V Combustion diagnositics
2167048, WS 18/19, 2 SWS, Open in study portal — **Lecture (V)**

**Learning Content**

Diagnostical methods: Laser induced fluorescence, Rayleigh-scattering, Raman-scattering
Chemoluminescence.
Reduced description of combustion processes and measurements.
Discussion of the potential and limits of specific strategies in different combustion systems.

**Workload**

Regular attendance: 22.5 h

Self-study, exam preparation: 97.5 h

**Literature**

Lecture notes

A.C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species,
Abacus Press, 2nd ed. (1996)

W. Demtröder, Laser Spectroscopy: Basic Concepts and Instrumentation,
Springer, 3rd ed., 2003

Hollas J.M. Modern Spectroscopy, Wiley, 3rd ed., 1996
K. Kohse-Höinghaus, J. B. Jeffries (ed.), Applied Combustion Diagnostics,
Taylor and Francis

Atkins P., Paula, J., Physical Chemistry, 8th ed., Oxford University Press,
2006

## T 3.52 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-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133113 | Combustion Engines I | 4 SWS | Lecture / Practice (VÜ) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102194 | Combustion Engines I | | Prüfung (PR) | Koch, Kubach |
| WS 18/19 | 76-T-MACH-102194 | Combustion Engines I | | Prüfung (PR) | Kubach, Koch |

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

**Prerequisites**
none

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

### V Combustion Engines I
2133113, WS 18/19, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
Introduction, History, Concepts
Working Principle and Termodynamics

Characteristic Parameters

Air Path

Fuel Path

Energy Conversion

Fuels

Emissions

Exhaust Gas Aftertreatment

**Workload**
regular attendance: 32 hours
self-study: 88 hours

## 3.53 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-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134151 | Combustion Engines II | 3 SWS | Lecture / Practice (VÜ) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-104609 | Combustion Engines II | | Prüfung (PR) | Koch, Kubach |
| WS 18/19 | 76-T-MACH-104609 | Combustion Engines II | | Prüfung (PR) | Kubach, Koch |

**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:*

### Combustion Engines II

2134151, SS 2018, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
Emissions

Fuels

Drive Train Dynamics

Engine Parts

Boosting

Alternative Powertrain Concepts

Special Engine Concepts

Power Transmission

**Workload**
regular attendance: 31,5 hours
self-study: 90 hours

## T 3.54 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114053 | Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | 2 SWS | Lecture (V) | Henning |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | | Prüfung (PR) | Henning |
| WS 18/19 | 76-T-MACH-105535 | Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies | | Prüfung (PR) | Henning |

**Competence Certificate**
written exam 90 minutes

**Prerequisites**
none

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

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

**Lecture (V)**

2114053, SS 2018, 2 SWS, Open in study portal

**Learning 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

**Workload**
lectures: 21h, preparation of examination: 79h

# T 3.55 Course: Computational Dynamics [T-MACH-105349]

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

**Part of:** M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2162246 | Computational Dynamics | 2 SWS | Event (Veranst.) | Proppe |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105349 | Computational Dynamics | | Prüfung (PR) | Proppe |
| WS 18/19 | 76-T-MACH-105349 | Computational Dynamics | | Prüfung (PR) | Proppe |

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

**Prerequisites**
none

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

## V Computational Dynamics
2162246, SS 2018, 2 SWS, Open in study portal

**Event (Veranst.)**

**Learning 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

**Annotation**
The course takes place every two years (in pair years).

**Workload**
Lectures: 20 h

Self-studies: 100 h

**Literature**
1. Lecture notes (in German) will be provided!

2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

## T 3.56 Course: Computational Homogenization on Digital Image Data [T-MACH-109302]

**Responsible:** Dr. rer. nat. Matti Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Expansion | Version |
|---|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 terms | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161123 | Computational homogenization on digital image data | 2 SWS | Lecture (V) | Schneider |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-109302 | Computational Homogenization on Digital Image Data | | Prüfung (PR) | |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
nein

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

### V Computational homogenization on digital image data

**Lecture (V)**

2161123, WS 18/19, 2 SWS, Open in study portal

**Description**
Contents of the lectures "Advanced Methods in Strength of Materials" or "Mathematical Methods in Strength of Materials" are required

**Learning Content**
Contents:
* basic equations for computing effective elastic material properties
* Moulinec-Suquet's FFT-based computational homogenization method
* schemes for treating highly contrasted/porous/defected media
* treating non-linear and time dependent mechanical proplems

**Workload**
regular attendance: 42 hours (together with tutorial No 2161124)
self-study: 138 hours

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

## T 3.57 Course: Computational Intelligence [T-MACH-105314]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105016 | Computational Intelligence | 2 SWS | Lecture (V) | Mikut, Jakob, Reischl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105314 | Computational Intelligence | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105314 | Computational Intelligence | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

### V Computational Intelligence
2105016, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

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

**Learning 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

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

**Literature**

Lecture notes (ILIAS)

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

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

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

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

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

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

## T 3.58 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161147 | Übungen zu Rechnerunterstützte Mechanik I | 2 SWS | Practice (Ü) | Albiez, Erdle |
| WS 18/19 | 2161250 | Computational Mechanics I | 2 SWS | Lecture (V) | Langhoff, Böhlke |
| WS 18/19 | 2161312 | Sprechstunde zu Rechnerunterstützte Mechanik I | 2 SWS | Consultation-hour (Sprechst.) | Erdle |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105351 | Computational Mechanics I | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105351 | Computational Mechanics I | | Prüfung (PR) | Langhoff, Böhlke |

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

### V Computational Mechanics I

2161250, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- numerical solution of linear systems
- basics of boundary value problems of linear elasticity
- solution methods of boundary value problem of linear elasticity;
- matrix displacement method
- variational principles of linear elasticity
- finite-element-technology for linear static problems

**Workload**
regular attendance: 42 hours
self-study: 138 hours

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

## T 3.59 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162206 | Sprechstunde zu Rechnerunterstützte Mechanik II | 2 SWS | Consultation-hour (Sprechst.) | Ruck, Erdle |
| SS 2018 | 2162296 | Computational Mechanics II | 2 SWS | Lecture (V) | Böhlke, Langhoff |
| SS 2018 | 2162297 | Übungen zu 'Rechnerunterstützte Mechanik II' | 2 SWS | Practice (Ü) | Ruck, Erdle, Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105352 | Computational Mechanics II | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105352 | Computational Mechanics II | | Prüfung (PR) | Langhoff, Böhlke |

**Competence Certificate**
oral examination

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

### V Computational Mechanics II

2162296, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

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

**Workload**
regular attendance: 42 hours
self-study: 138 hours

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

# T 3.60 Course: Computational Vehicle Dynamics [T-MACH-105350]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162256 | Computational Vehicle Dynamics | 2 SWS | Lecture (V) | Proppe |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105350 | Computational Vehicle Dynamics | | Prüfung (PR) | Proppe |
| WS 18/19 | 76-T-MACH-105350 | Computational Vehicle Dynamics | | Prüfung (PR) | Proppe |

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

**Prerequisites**
none

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

## V Computational Vehicle Dynamics

**Lecture (V)**

2162256, SS 2018, 2 SWS, Open in study portal

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

**Annotation**
The course takes place every two years (impair years only).

**Workload**
Lectures: 20 h

Self-studies: 100 h

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

# T 3.61 Course: Computer Engineering [T-MACH-105360]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2106002 | Computer Engineering | 2 SWS | Lecture (V) | Keller, Lorch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105360 | Computer Engineering | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105360 | Computer Engineering | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

## V Computer Engineering

2106002, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Introduction: definitions, basic concepts, introductory examples

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

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

Sorting algorithms: relevance, algorithms, simplifications, examples

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

Lectures are complemented by an exercice course.

**Workload**
regular attendance: 31,5 hours
self-study: 73,5 hours

**Literature**
Lecture Notes (Ilias)

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

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

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

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

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

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

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

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

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

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

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

## T 3.62 Course: Computerized Multibody Dynamics [T-MACH-105384]

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

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| SS 2018 | 76-T-MACH-105384 | Computerized Multibody Dynamics | Prüfung (PR) | Seemann |
| WS 18/19 | 76-T-MACH-105384 | Computerized Multibody Dynamics | Prüfung (PR) | Seemann |

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

**Prerequisites**
none

**Recommendation**
Knowledge of EM III/IV

## T 3.63 Course: Constitution and Properties of Protective Coatings [T-MACH-105150]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2177601 | Constitution and Properties of Protective Coatings | 2 SWS | Lecture (V) | Ulrich |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105150 | Constitution and Properties of Protective Coatings | | Prüfung (PR) | Ulrich |
| WS 18/19 | 76-T-MACH-105150 | Constitution and Properties of Protective Coatings | | Prüfung (PR) | Ulrich |

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

no tools or reference materials

**Prerequisites**
none

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

### V Constitution and Properties of Protective Coatings

2177601, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 22 hours
self-study: 98 hours

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

Copies with figures and tables will be distributed

# T 3.64 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2194643 | Constitution and Properties of Wear resistant materials | 2 SWS | Lecture (V) | Ulrich |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102141 | Constitution and Properties of Wearresistant Materials | | Prüfung (PR) | Ulrich |
| WS 18/19 | 76-T-MACH-102141 | Constitution and Properties of Wearresistant Materials | | Prüfung (PR) | Ulrich |

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

no tools or reference materials

**Prerequisites**
none

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

## V Constitution and Properties of Wear resistant materials

2194643, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellites and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

**Workload**
regular attendance: 22 hours
self-study: 98 hours

**Literature**

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

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

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

Copies with figures and tables will be distributed

## T 3.65 Course: Contact Mechanics [T-MACH-105786]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2181220 | Contact Mechanics | 2 SWS | Lecture (V) | Greiner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105786 | Contact Mechanics | | Prüfung (PR) | |
| WS 18/19 | 76-T-MACH-105786 | Contact Mechanics | | Prüfung (PR) | |

**Competence Certificate**
oral exam ca. 30 minutes

**Prerequisites**
none

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

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

### V Contact Mechanics

2181220, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

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

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

**Workload**
regular attendance: 22,5 hours

self-study: 97,5 hours

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

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

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

## T 3.66 Course: Control Technology [T-MACH-105185]

**Responsible:** Christoph Gönnheimer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150683 | Control Technology | 2 SWS | Lecture (V) | Gönnheimer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105185 | Control Technology | | Prüfung (PR) | Fleischer |
| WS 18/19 | 76-T-MACH-105185 | Control Technology | | Prüfung (PR) | Fleischer |

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

**Prerequisites**
none

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

### V Control Technology
2150683, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

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

**Learning 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
- Process control systems
- Field bus
- Trends in the area of control technology

**Annotation**
None

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

## T 3.67 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2170463 | Cooling of thermally high loaded gas turbine components | 2 SWS | Lecture (V) | Schulz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105414 | Cooling of Thermally High Loaded Gas Turbine Components | | Prüfung (PR) | Bauer, Schulz |
| WS 18/19 | 76-T-MACH-105414 | Cooling of Thermally High Loaded Gas Turbine Components | | Prüfung (PR) | Bauer, Schulz |

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

**Prerequisites**
none

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

### V Cooling of thermally high loaded gas turbine components
2170463, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

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

**Workload**
regular attendance: 21 h
self-study: 42 h

## T 3.68 Course: Current Topics on BioMEMS [T-MACH-102176]

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

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2143873 | Actual topics of BioMEMS | 2 SWS | Seminar (S) | Guber |
| WS 18/19 | 2143873 | Actual topics of BioMEMS | 2 SWS | Seminar (S) | Guber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102176 | Current Topics on BioMEMS | | Prüfung (PR) | Guber |
| WS 18/19 | 76-T-MACH-102176 | Current Topics on BioMEMS | | Prüfung (PR) | Guber |

**Competence Certificate**
active participation and own presentation (30 Min.)

**Prerequisites**
none

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

### V Actual topics of BioMEMS

2143873, SS 2018, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
**Media:**
Written preparations from the participants.

**Workload**
Active participation on the seminary and preparation of an own presentation of a topic in BioMEMS.

Lecture time: 21 h

Preparation: 40 h

Preparation of own preparation: 60 h

### V Actual topics of BioMEMS

2143873, WS 18/19, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
**Media:**

Written preparations from the participants.

**Workload**
Active participation on the seminary and preparation of an own presentation of a topic in BioMEMS.

Lecture time: 21 h

Preparation: 40 h

Preparation of own preparation: 60 h

## T 3.69 Course: Data Analytics for Engineers [T-MACH-105694]

**Responsible:** Nicole Ludwig
Prof. Dr. Ralf Mikut
PD Dr.-Ing. Markus Reischl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2106014 | Datenanalyse für Ingenieure | 3 SWS | Lecture / Practice (VÜ) | Mikut, Reischl, Ludwig |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105694 | Datenanalyse für Ingenieure | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105694 | Datenanalyse für Ingenieure | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

### V Datenanalyse für Ingenieure

2106014, SS 2018, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning 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 Gait-CAD): Data import, benchmark datasets, control of hand prostheses, energy prediction
- 2 hours per week lectures, 1 hour per week computer training

**Workload**
regular attendance: 32 hours
self-study: 118 hours

**Literature**

Lecture notes (ILIAS)

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

2008 (free PDF in the Internet)

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

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

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

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

## T 3.70 Course: Decentrally Controlled Intralogistic Systems [T-MACH-105230]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
Maximilian Hochstein

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117084 | Decentrally controlled intralogistic systems | 2 SWS | Practical course (P) | Furmans, Hochstein |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105230 | Decentrally Controlled Intralogistic Systems | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105230 | Decentrally Controlled Intralogistic Systems | | Prüfung (PR) | Furmans |

**Competence Certificate**
Certificate by colloquium with presentation

**Prerequisites**
None

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

### V Decentrally controlled intralogistic systems

2117084, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Description**
**Media:**

Lego Mindstorms, PC

**Learning Content**

- Introduction to material handling systems
- Construction of a model for decentralized logistic systems
- object-oriented programming with LabView
- Implementation of the model with Mindstorms

Presentation of the results

**Annotation**
number of participants limited

participants will be selected

One course during summer semester in english

**Workload**
regular attendance: 10 hours
self-study: 80 hours (workplace is provided)

**Literature**
none

## T 3.71 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113079 | Design and Development of Mobile Machines | 2 SWS | Lecture (V) | Geimer, Siebert, Geiger |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105311 | Design and Development of Mobile Machines | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105311 | Design and Development of Mobile Machines | | Prüfung (PR) | Geimer |

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

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

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

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

### Modeled Conditions
The following conditions have to be fulfilled:

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

### Recommendation
Knowledge in Fluid Power Systems (LV 2114093)

**Annotation**
After completion of the lecture, studens can:

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

The number of participants is limited.

**Conent:**

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

**Literature:**

See german recommendations

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

| V | **Design and Development of Mobile Machines**<br>2113079, WS 18/19, 2 SWS, Open in study portal | **Lecture (V)** |
|---|---|---|

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

- Defining the size and dimensions,
- the dimensioning of the drive train,
- 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.

**Workload**

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

**Literature**
None.

## T 3.72 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108887 | Design and Development of Mobile Machines - Advance | Prüfung (PR) | Geimer |

**Competence Certificate**
Preparation of semester report

**Prerequisites**
none

## T 3.73 Course: Design of a jet engine combustion chamber [T-CIWVT-105780]

**Responsible:** Prof. Dr.-Ing. Nikolaos Zarzalis
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 22527 | Design of a jet engine combustion chamber | SWS | Project/Seminar (PJ/S) | Zarzalis |

**Competence Certificate**
The examination is an oral examination on lecture 22527 with a duration of 20 minutes.

**Prerequisites**
None

## T 3.74 Course: Design of Highly Stresses Components [T-MACH-105310]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102643 - Schwerpunkt: Fusionstechnologie
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181745 | Design of highly stresses components | 2 SWS | Lecture (V) | Aktaa |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105310 | Design of Highly Stresses Components | | Prüfung (PR) | Aktaa |
| WS 18/19 | 76-T-MACH-105310 | Design of Highly Stresses Components | | Prüfung (PR) | Aktaa |

**Competence Certificate**
oral exam

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

### V Design of highly stresses components
2181745, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**

- R. Viswanathan, Damage Mechanisms and Life Assessment of High-Temperature Components, ASM International, 1989.
- Lemaitre, J.; Chaboche J.L.: Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

## T 3.75 Course: Design Project Machine Tools and Industrial Handling [T-MACH-105227]

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

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149903 | Design Project Machine Tools and Industrial Handling | 2 SWS | Project group (Pg) | Fleischer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105227 | Design Project Machine Tools and Industrial Handling | | Prüfung (PR) | Fleischer |
| WS 18/19 | 76-T-MACH-105227 | Design Project Machine Tools and Industrial Handling | | Prüfung (PR) | Fleischer |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
The Design Project Machine Tools an Industrial Handling can only be combined with the lecture Machine Tools and Industrial Handling (T-MACH-102158 oder T-MACH-109055).

The number of students is limited to five.

**Modeled Conditions**
You have to fulfill one of 2 conditions:

1. The course T-MACH-102158 - Machine Tools and Industrial Handling must have been started.
2. The course T-MACH-109055 - Machine Tools and Industrial Handling must have been started.

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

### V Design Project Machine Tools and Industrial Handling

2149903, WS 18/19, 2 SWS, Open in study portal

**Project group (Pg)**

**Description**
**Media:**

SharePoint, Siemens NX 11.0

**Notes**
The dates and deadlines for the event will be published on the homepage http://www.wbk.kit.edu/studium-und-lehre.php. The number of participants is limited to five students.

**Learning Content**

The Design Project Machine Tools and Industrial Handling offers a practical insight into the development of machine tools. A student team works on a current and concrete problem in the field of machine tools. This problem is introduced into the project by an industrial partner.

First, the problem is to be translated into work packages. Following the project plan, ideas and concepts are to be developed as to how the problem is to be solved. Based on the concepts, the validation is carried out using analytical and numerical methods. The results of the project will be presented in a final meeting. The project is carried out by the students under the guidance of scientific staff and in cooperation with the industrial partner. The development project offers students

- the unique opportunity to put the contents of the accompanying lecture into practice in an interdisciplinary and creative context,
- to gain insights into a wide range of development activities relevant for their future careers,
- cooperation with an attractive industrial partner,
- work in a team with other students with competent support from scientific staff,
- first practical experience in project management.

**Workload**

regular attendance: 21 hours
self-study: 99 hours

## T 3.76 Course: Design Project Production Science for E-mobility (DPEM) [T-MACH-106878]

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

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150990 | Design Project Production Science for E-mobility (DPEM) | 2 SWS | Project group (Pg) | Fleischer |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106878 | Design Project Production Science for E-mobility (DPEM) | | Prüfung (PR) | Fleischer |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
none

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

### V Design Project Production Science for E-mobility (DPEM)
2150990, SS 2018, 2 SWS, Open in study portal

**Project group (Pg)**

**Description**
Media:

SharePoint, Siemens NX 9.0

**Notes**
The dates and deadlines for the event will be published on the homepage http://www.wbk.kit.edu/studium-und-lehre.php. The number of participants is limited to five students.

**Learning Content**
The tutorial Design Project Production Science for e-mobility provides an inside view of the development of machines for the production of battery modules and electric motors. Within the project students are enabled to design a machine, based on a specified process by the corporate- or research partner or according to workpiece specifications. First a machining strategy is deduced. With this strategy students are enabled to calculate the relevant technological specifications and functions. Next step is to create concepts for the realization. In the end the solution is designed (CAD) and optimized with FEA methods. Aside a target costing approach is executed for remaining within the specified costs.
The Project is executed by the students under the instruction and in cooperation with the corporate- or research partner.
It offers:

- an unique opportunity to implement the learned knowledge interdisciplinary and creatively
- inside views into manifold development and design work
- Co-operation with first-grade cooperate- or research partners
- work within a student team and professional support by research associates.

**Annotation**
The number of students is limited to five.

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

**Literature**
none

## T 3.77 Course: Design Thinking [T-WIWI-102866]

**Responsible:** Prof. Dr. Orestis Terzidis
**Organisation:** KIT Department of Economics and Management
**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2545008 | Design Thinking (Track 1) | 2 SWS | Seminar (S) | Terzidis, Haller, Jochem |
| WS 18/19 | 2545008 | Design Thinking (Track 1) | 2 SWS | Seminar (S) | Tittel, Jochem, Terzidis |
| WS 18/19 | 2545009 | Design Thinking (Track 2) | 2 SWS | Seminar (S) | Haller, Terzidis |
| **Exams** | | | | | |
| SS 2018 | 7900053 | Design Thinking (Track 1) | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900025 | Design Thinking (Track 2) | | Prüfung (PR) | Terzidis |

**Competence Certificate**
Alternative exam assessments (§4(2), 3 SPO).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The seminar content will be published on the website of the institute.

# T 3.78 Course: Design with Plastics [T-MACH-105330]

**Responsible:** Markus Liedel
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2174571 | Design with Plastics | 2 SWS | Lecture (V) | Liedel |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105330 | Design with Plastics | | Prüfung (PR) | Liedel |
| WS 18/19 | 76-T-MACH-105330 | Design with Plastics | | Prüfung (PR) | Liedel |

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

**Prerequisites**
none

**Recommendation**
Poly I

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

## V Design with Plastics

**Lecture (V)**

2174571, SS 2018, 2 SWS, Open in study portal

**Learning 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.

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

**Literature**
Scriptum will be handed out during the lecture.
Recommended literature are provided in the lecture.

# T 3.79 Course: Designing with Composites [T-MACH-108721]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108721 | Designing with Composites | Prüfung (PR) | |

**Competence Certificate**
Oral exam, 20 minutes

**Prerequisites**
None

**Annotation**
The lecture notes are made available via ILIAS.

## T 3.80 Course: Designing with numerical methods in product development [T-MACH-108719]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161229 | Designing with numerical methods in product development | 2 SWS | Lecture (V) | Schnack |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108719 | Designing with numerical methods in product development | | Prüfung (PR) | |

**Competence Certificate**
Oral examination (duration: 20 min)

**Prerequisites**
None

**Annotation**
The lecture notes are made available via ILIAS.

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

### V Designing with numerical methods in product development
2161229, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Overview of the numeric process: finite difference methods, finite volume methods. Finite element methods. Boundary element method (BEM). Thermodynamic processes. Flow dynamic processes. Solid dynamics. Non-linear field behaviour. These methods are summarised at the end of the course, and a holistic concept for design processes is developed.

**Workload**
Contact time: 22.5 hrs; Self-study: 97.5 hrs

**Literature**
Lecture notes (available in the administration office, building 10.91, rm. 310)

## T 3.81 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113072 | Development of Oil-Hydraulic Powertrain Systems | 2 SWS | Block lecture (BV) | Geerling, Ays, Becker |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105441 | Development of Oil-Hydraulic Powertrain Systems | | Prüfung (PR) | Geimer |

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

**Prerequisites**
none

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

### V Development of Oil-Hydraulic Powertrain Systems

2113072, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning 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

**Workload**

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

## T 3.82 Course: Digital Control [T-MACH-105317]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2137309 | Digital Control | 2 SWS | Lecture (V) | Knoop |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105317 | Digital Control | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105317 | Digital Control | | Prüfung (PR) | Stiller |

**Competence Certificate**
written exam

60 min.

**Prerequisites**
none

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

## V Digital Control

2137309, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
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

**Workload**
120 hours

**Literature**


- Lunze, J.: Regelungstechnik 2, 3. Auflage, Springer Verlag, Berlin Heidelberg 2005
- Unbehauen, H.: Regelungstechnik, Band 2: Zustandsregelungen, digitale und nichtlineare Regelsysteme. 8. Auflage, Vieweg Verlag, Braunschweig 2000
- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
- Ogata, K.: Discrete-Time Control Systems. 2nd edition, Prentice-Hall, Englewood Cliffs 1994
- Ackermann, J.: Abtastregelung, Band I, Analyse und Synthese. 3. Auflage, Springer Verlag, Berlin Heidelberg 1988

## T 3.83 Course: Digital microstructure characterization and modeling [T-MACH-108460]

**Responsible:** Dr. rer. nat. Matti Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162277 | Digital Microstructure Characterization and Modeling | 4 SWS | Lecture / Practice (VÜ) | Schneider |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108460 | Digital microstructure characterization and modeling | | Prüfung (PR) | |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none

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

### V Digital Microstructure Characterization and Modeling

2162277, SS 2018, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
* homogenization theory of heterogeneous materials
* digital microstructure characterization
* virtual microstructure generation
* specifics for fiber reinforced composites

**Literature**

- Torquato, S.: Random Heterogeneous Materials. Springer, New York, 2002.
- Ohser, J. und Schladitz, K.: 3D images of Materials Structures. Wiley, Hoboken, 2009

## T 3.84 Course: Digitalization of Products, Services & Production [T-MACH-108491]

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2122310 | Digitalization of Products, Services & Production | 2 SWS | Seminar (S) | Pätzold |
| WS 18/19 | 2122310 | Digitalization of Products, Services & Production | 2 SWS | Seminar (S) | Pätzold |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-108491 | Digitalization of Products, Services & Production | | Prüfung (PR) | Pätzold |
| WS 18/19 | 76-T-MACH-108491 | Digitalization of Products, Services & Production | | Prüfung (PR) | Pätzold |

**Competence Certificate**
Assessment of another type. Two presentations in team work and two written compositions. Grading: each composition 1/6 and each presentation 2/3.

**Prerequisites**
none

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

### V Digitalization of Products, Services & Production
2122310, SS 2018, 2 SWS, Open in study portal

**Seminar (S)**

**Learning Content**

- Digitalization of products, services and production in the context of Industry 4.0 .
- Key drivers for ongoing digitalization and their impact on future product development and manufacturing.
- Methods and procedures to design the according transformation process.
- Intensive group discussions of use-case scenarios using practical examples from the industry.

### V Digitalization of Products, Services & Production
2122310, WS 18/19, 2 SWS, Open in study portal

**Seminar (S)**

**Learning Content**

- Digitalization of products, services and production in the context of Industry 4.0 .
- Key drivers for ongoing digitalization and their impact on future product development and manufacturing.
- Methods and procedures to design the according transformation process.
- Intensive group discussions of use-case scenarios using practical examples from the industry.

## T 3.85 Course: Dimensioning and Optimization of Power Train System [T-MACH-105536]

**Responsible:** Dr.-Ing. Hartmut Faust
Dr. Eckhard Kirchner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146208 | Dimensioning and Optimization of Power Train System | 2 SWS | Lecture (V) | Faust |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105536 | Dimensioning and Optimization of Power Train System | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105536 | Dimensioning and Optimization of Power Train System | | Prüfung (PR) | Albers |

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

**Prerequisites**
none

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

### V Dimensioning and Optimization of Power Train System

2146208, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. Architectures: conventional, hybrid and electrical transmissions
2. The gear as system in a vehicle
3. Components and power flow ofsynchromesh gears
4. Spur gears
5. Synchronization
6. Switching systems for vehicles with manual transmission
7. Actuators
8. Comfort aspects for manual transmissions
9. Torque converter
10. Planetary sets
11. Power conversion in automatic transmissions
12. Continuously variable transmission systems
13. Differentials and components for power split
14. Drive train for commercial vehicles
15. Gears and electrical machines for electro mobility

**Workload**
regular attendance: 21 h

self-study: 99 h

## T 3.86 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-102824 - Schlüsselqualifikationen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2109039 | Do it! – Service-Learning for prospective mechanical engineers | 2 SWS | Lecture (V) | Deml |

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

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

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

### V Do it! – Service-Learning for prospective mechanical engineers

**Lecture (V)**

2109039, WS 18/19, 2 SWS, Open in study portal

**Literature**
Course material will be provided in ILIAS.

## T 3.87 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-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133112 | Drive Systems and Possibilities to Increase Efficiency | 1 SWS | Lecture (V) | Kollmeier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105451 | Drive Systems and Possibilities to Increase Efficiency | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105451 | Drive Systems and Possibilities to Increase Efficiency | | Prüfung (PR) | Koch |

**Competence Certificate**
Oral examination, time duration 30 min., no aids

**Prerequisites**
none

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

### V Drive Systems and Possibilities to Increase Efficiency
2133112, WS 18/19, 1 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture with powerpoint slides

**Learning Content**
The students attend to propulsion systems and possibilities for increasing efficiency and get an overview about the demand of energy of stationary and mobile propulsion systems. Furthermore they get an overview about possibilities for increasing efficiency by the use of storage systems, systems of waste heat recovery and lightweight construction systems. There is also a view on complete systems for increasing efficiency as combined heat and power plant and hybrid propulsion systems.

**Annotation**
none

**Workload**
Time of attendence: 11 h
self-study: 49 h (grob abschätzen, Richtwert: 2 bis 4 mal Präsenzzeit)

**Literature**
Download of powerpoint slides

## T 3.88 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113077 | Drive Train of Mobile Machines | 2 SWS | Lecture (V) | Geimer, Herr |
| WS 18/19 | 2113078 | Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen' | 1 SWS | Practice (Ü) | Geimer, Herr |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105307 | Drive Train of Mobile Machines | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105307 | Drive Train of Mobile Machines | | Prüfung (PR) | Geimer |

### Competence Certificate
The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in ervery semester and can be repeated at any regular examination date.

### Prerequisites
none

### Recommendation

- General principles of mechanicals engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

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

**Content:**

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

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

**Media:** projector presentation

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

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

## V Drive Train of Mobile Machines

2113077, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

projector presentation

**Learning Content**
In this course will be discussed the different drive train of mobile machinerys. The fokus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- eletrical drives
- hybrid drives
- axles
- terra mechanic

**Workload**

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

**Literature**
download of scriptum via ILIAS

# T 3.89 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2163111 | Dynamics of the Automotive Drive Train | 2 SWS | Lecture (V) | Fidlin |
| WS 18/19 | 2163112 | Übungen zu Dynamik des Kfz-Antriebsstrangs | 2 SWS | Practice (Ü) | Fidlin, Aramendiz Fuentes |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105226 | Dynamics of the Automotive Drive Train | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105226 | Dynamics of the Automotive Drive Train | | Prüfung (PR) | Fidlin |

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

**Prerequisites**
none

**Recommendation**
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

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

## V Dynamics of the Automotive Drive Train

2163111, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

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

**Workload**
time of attendance: 39 h
self-study: 201 h

**Literature**

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

## T 3.90 Course: Electric Rail Vehicles [T-MACH-102121]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114346 | Electric Rail Vehicles | 2 SWS | Lecture (V) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102121 | Electrical Railway Traction Systems | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-102121 | Electric Rail Vehicles | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-102122 | Electric Rail Vehicles | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Oral examination

Duration: 20 minutes

No tools or reference materials may be used during the exam.

**Prerequisites**
none

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

### V Electric Rail Vehicles

2114346, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

All slides are available for download (Ilias-platform).

**Learning Content**
History of electric traction with railway vehicles, economic impact

Vehicle dynamics: running resistance, tractive effort diagram, running cycles

Wheel-rail-contact

Electric drives: traction motors, power conversion, drives for vehicles at dc and ac lines, dieselelectric vehicles, multi system vehicles, axle drives, transmission of tractive effort to the rails

Traction power supply: networks, substations, inductive power supply, energy management

Modern vehicle concepts for mass transit and main line

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
A bibliography is available for download (Ilias-platform).

## T 3.91 Course: Electrical Engineering for Business Engineers, Part II [T-ETIT-100534]

**Responsible:** Dr. Wolfgang Menesklou
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2304224 | Elektrotechnik II für Wirtschaftsingenieure | 3 SWS | Lecture (V) | Menesklou |
| **Exams** | | | | | |
| SS 2018 | 7304224 | Electrical Engineering for Business Engineers, Part II | | Prüfung (PR) | Menesklou |
| WS 18/19 | 7304224 | Electrical Engineering for Business Engineers, Part II | | Prüfung (PR) | Menesklou |

# T 3.92 Course: Elements and Systems of Technical Logistics [T-MACH-102159]

**Responsible:** Georg Fischer
Dr.-Ing. Martin Mittwollen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117096 | Elements and systems of Technical Logistics | 3 SWS | Lecture / Practice (VÜ) | Mittwollen, Fischer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102159 | Elements and Systems of Technical Logistics | | Prüfung (PR) | Mittwollen |
| WS 18/19 | 76-T-MACH-102159 | Elements and Systems of Technical Logistics | | Prüfung (PR) | Mittwollen |

### Competence Certificate
The assessment consists of an oral exam (20min) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

### Prerequisites
none

### Recommendation
Knowledge out of Basics of Technical Logistics (T-MACH-102163) preconditioned

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

## V Elements and systems of Technical Logistics
2117096, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

### Learning Content

- material flow systems and their (conveying) technical components
- mechanical behaviour of conveyors;
- structure and function of conveyor machines; elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)
- sample applications and calculations in addition to the lectures inside practical lectures

### Annotation
Knowledge out of **Basics of Technical Logistics** preconditioned

### Workload
presence: 36h

rework: 84h

### Literature
recommendations during lectures

## T 3.93 Course: Elements and Systems of Technical Logistics - Project [T-MACH-108946]

**Responsible:** Georg Fischer
Dr.-Ing. Martin Mittwollen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117097 | Elements and systems of Technical Logistics - project | SWS | Project (PRO) | Mittwollen, Fischer |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108946 | Elements and Systems of Technical Logistics - Project | | Prüfung (PR) | Mittwollen |

**Competence Certificate**
Presentation of performed project and defense (30min) according to  $4 (2), No. 3 of the examination regulation

**Prerequisites**
T-MACH-102159 (Elements and Systems of Technical Logistics) must have been started

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-102159 - Elements and Systems of Technical Logistics must have been started.

**Recommendation**
Knowledge out of Basics of Technical Logistics (T-MACH-102163) preconditioned

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

### V Elements and systems of Technical Logistics - project

2117097, WS 18/19, SWS, Open in study portal

**Project (PRO)**

**Description**
**Media:**

supplementary sheets,presentations, blackboard

**Learning Content**

- mechanical behaviour of conveyors;
- structure and function of conveyor machines;
- elements of intralogistics (belt conveyor, racks, automatic guided vehicles, fan-in, bifurcation, and etc.)
- sample applications and calculations in addition to the lectures inside practical lectures
- Self manufacturing of a project report to recesses the topic.

**Annotation**
Knowledge out of **Basics of Technical Logistics (LV 2117095)** preconditioned

## T 3.94 Course: Energy and Indoor Climate Concepts [T-ARCH-107406]

**Responsible:** Prof. Andreas Wagner
**Organisation:** KIT Department of Architecture
**Part of:** M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 1720970 | Energy and Indoor Climate Concepts | 3 SWS | Lecture (V) | Wagner |
| **Exams** | | | | | |
| SS 2018 | 7000764 | Energy and Indoor Climate Concepts | | Prüfung (PR) | Wagner |

## T 3.95 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-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133121 | Energy Conversion and Increased Efficiency in Internal Combustion Engines | 2 SWS | Lecture (V) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105564 | Energy Conversion and Increased Efficiency in Internal Combustion Engines | | Prüfung (PR) | Koch, Kubach |
| WS 18/19 | 76-T-MACH-105564 | Energy Conversion and Increased Efficiency in Internal Combustion Engines | | Prüfung (PR) | Koch |

**Competence Certificate**
oral exam, 25 minutes, no auxillary means

**Prerequisites**
none

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

### V Energy Conversion and Increased Efficiency in Internal Combustion Engines

**Lecture (V)**

2133121, WS 18/19, 2 SWS, Open in study portal

**Learning 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. APR und DVA
9. Combustion in Diesel engines
10. Emissions
11. Waste heat recovery
12. Measures to increase efficiency

**Workload**
regular attendance: 24 hours, self-study: 96 hours

## T 3.96 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-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2158203 | Energy demand of buildings – fundamentals and applications, with building simulation exercises | 4 SWS | Lecture / Practice (VÜ) | Schmidt |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105715 | Energy demand of buildings – fundamentals and applications, with building simulation exercises | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105715 | Energy demand of buildings – fundamentals and applications, with building simulation exercises | | Prüfung (PR) | Gabi |

**Competence Certificate**
oral exam, 30 minutes

**Prerequisites**
none

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

### V Energy demand of buildings – fundamentals and applications, with building simulation exercises

**Lecture / Practice (VÜ)**

2158203, SS 2018, 4 SWS, Open in study portal

**Learning 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

**Literature**
same as in German, no English version of book by Pehnt (ed.) available)

# T 3.97 Course: Energy Efficient Intralogistic Systems [T-MACH-105151]

**Responsible:** Dr.-Ing. Meike Braun
Dr.-Ing. Frank Schönung

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2117500 | Energy efficient intralogistic systems | 2 SWS | Lecture (V) | Braun, Schönung |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105151 | Energy Efficient Intralogistic Systems | | Prüfung (PR) | Braun |
| WS 18/19 | 76-T-MACH-105151 | Energy Efficient Intralogistic Systems | | Prüfung (PR) | Braun |

**Competence Certificate**
Oral, 30 min. examination dates after the end of each lesson period.

**Prerequisites**
none

**Recommendation**
The content of course “Basics of Technical Logistics” should be known.

**Annotation**
Visit the IFL homepage of the course for the course dates and/or possible limitations of course participation.

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

## V Energy efficient intralogistic systems

2117500, WS 18/19, 2 SWS, Open in study portal **Lecture (V)**

**Description**
**Media:**
presentations, black board

**Notes**
The content of course “Basics of Technical Logistics” should be knownn.

**Learning Content**
The main focuses of the course are:

- green supply chain
- processes in Intralogistic systems
- evaluation of energy consumption of conveyors
- modeling of conveying systems
- methods for energy savings
- approaches for energy efficiency increasing of continuous and discontinuous conveyors
- dimensioning energy efficient drives
- new approaches for resource efficient conveying systems.

**Annotation**
Visit the IFL homepage of the course for the course dates and/or possible limitations of course participation

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

**Literature**
None.

# T 3.98 Course: Energy Market Engineering [T-WIWI-107501]

**Responsible:** Prof. Dr. Christof Weinhardt
**Organisation:** KIT Department of Economics and Management
**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4,5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2540464 | Energy Market Engineering | 2 SWS | Lecture (V) | Weinhardt, Staudt |
| SS 2018 | 2540465 | Übung zu Energy Market Engineering | 1 SWS | Practice (Ü) | Staudt, Mengelkamp |
| **Exams** | | | | | |
| SS 2018 | 7900209 | Energy Market Engineering | | Prüfung (PR) | Weinhardt |
| SS 2018 | 79852 | Energy Market Engineering | | Prüfung (PR) | Weinhardt |
| WS 18/19 | 7901171 | Energy Market Engineering | | Prüfung (PR) | Weinhardt |

**Competence Certificate**
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".

The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

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

## V Energy Market Engineering

2540464, SS 2018, 2 SWS, Open in study portal — **Lecture (V)**

**Learning Content**
This lecture discusses different design options for electricity markets. We will focus on different approaches of nodal and zonal pricing as well as single price mechanisms and capacity markets. After a short recap of German and European market designs, the different design options will be discussed scientifically and with the help of examples. Furthermore, we will evaluate alternative market design options like microgrids. Besides the fundamental functioning of those markets, we will introduce and discuss methodological knowledge to evaluate market design options.

**Annotation**
The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

**Workload**
The total workload for this course is approximately 135.0 hours. For further information see German version.

**Literature**


- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX *. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

## T 3.99 Course: Energy Storage and Network Integration [T-MACH-105952]

**Responsible:** Dr.-Ing. Wadim Jäger
Prof. Dr. Robert Stieglitz

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189487 | Energiespeicher und Netzintegration | 2 SWS | Lecture (V) | Jäger, Stieglitz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105952 | Energiespeicher und Netzintegration | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105952 | Energiespeicher und Netzintegration | | Prüfung (PR) | Stieglitz |

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

**Prerequisites**
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

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

### V Energiespeicher und Netzintegration

2189487, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid.

Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

# T 3.100 Course: Energy Systems I: Renewable Energy [T-MACH-105408]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2129901 | Energy Systems I - Renewable Energy | 3 SWS | Lecture (V) | Dagan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105408 | Energy Systems I: Renewable Energy | | Prüfung (PR) | Stieglitz, Dagan |
| WS 18/19 | 76-T-MACH-105408 | Energy Systems I: Renewable Energy | | Prüfung (PR) | Dagan |

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

**Prerequisites**
none

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

## V Energy Systems I - Renewable Energy

2129901, WS 18/19, 3 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
regular attendance: 34 hours
self-study: 146 hours

## T 3.101 Course: Energy systems II: Reactor Physics [T-MACH-105550]

**Responsible:** Dr. Aurelian Florin Badea
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102608 - Schwerpunkt: Kerntechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2130929 | Energy systems II: Reactor Physics | 2 SWS | Lecture (V) | Badea |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105550 | Energy Systems II: Reactor Physics | | Prüfung (PR) | Badea |
| WS 18/19 | 76-T-MACH-105550 | Energy Systems II: Reactor Physics | | Prüfung (PR) | Badea |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

### V Energy systems II: Reactor Physics

2130929, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
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

# T 3.102 Course: Engine Laboratory [T-MACH-105337]

**Responsible:** Dr.-Ing. Uwe Wagner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134001 | Engine Laboratory | 2 SWS | Practical course (P) | Wagner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105337 | Engine Laboratory | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105337 | Engine Laboratory | | Prüfung (PR) | Koch |

**Competence Certificate**
written documentation of every experiment, certificate of successful attendance, no grading

**Prerequisites**
none

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

## V Engine Laboratory
2134001, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
5 engine experiments in up-to-date development projects

**Workload**
regular attendance: 40 hours
self-study: 80 hours

**Literature**
Description of experiments

# T 3.103 Course: Engine Measurement Techniques [T-MACH-105169]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134137 | Engine measurement techniques | 2 SWS | Lecture (V) | Bernhardt |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105169 | Engine Measurement Techniques | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105169 | Engine Measurement Techniques | | Prüfung (PR) | Koch |

**Competence Certificate**
oral examination, Duration: 0,5 hours, no auxiliary means

**Prerequisites**
none

**Recommendation**
T-MACH-102194 Combustion Engines I

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

## V Engine measurement techniques

2134137, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Students get to know state-of-the-art measurement techniques for combustion engines. In particular basic techniques for measuring engine operating parameters such as torque, speed, power and temperature.

Possible measurement errors and abberations are discussed.

Furthermore techniques for measuring exhaust emissions, air/fuel ratio, fuel consumption as well as pressure indication for thermodynamic analysis are covered.

**Workload**
regular attendance: 21 hours
self-study: 100 hours

**Literature**

1. Grohe, H.:Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C

# T 3.104 Course: Engineer's Field of Work [T-MACH-105721]

**Responsible:** Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Peter Gratzfeld

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102824 - Schlüsselqualifikationen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung schriftlich | 2 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114917 | Engineer's Field of Work | 2 SWS | Lecture (V) | Gratzfeld, Doppelbauer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105721 | Engineer's Field of Work | | Prüfung (PR) | Gratzfeld, Doppelbauer |
| WS 18/19 | 76-T-MACH-105721 | Engineer's Field of Work | | Prüfung (PR) | Gratzfeld, Doppelbauer |

**Competence Certificate**
written test

Duration: 30 minutes

result: passed / not passed

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 Engineer's Field of Work

2114917, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

**AFI1: Organization of Companies (Peter Gratzfeld)**
organizational structure, organizational units, managerial structure, organization charts, project organization, relation between superior and staff, board of managing directors, management of the company, supervisory board, advisory board

**AFI 2: Project Management (Peter Gratzfeld)**
definition of project, project manager, project team, primary processes, supporting processes

**AFI3: Personnel Development (Martin Doppelbauer)**
applications, trainee programs, management career, professional career, career paths in companies, individual career planning, tasks of HR, manpower requirements planning, training, training-on-the-job, tools for human resource management, annual personnel talk, objective agreement

**AFI4: Scheduling (Peter Gratzfeld)**
Methods for detailed scheduling, network plans, critical path, Gantt-diagram, milestones

**AFI5a/b: Development Processes (Martin Doppelbauer)**
research, advance development, series development, product marketing, V-model, SPALTEN-model, technical specifications, requirement specifications, clarification, concept, draft, elaboration, validation, verification, documentation, FMEA

**AFI6: Standards and Laws (Martin Doppelbauer)**
importance of standards, German and international standardization systems, committees, certification

**AFI7: Commercial Law (Martin Doppelbauer)**
health protection, safety at work, environment protection, product liability, patents

**AFI8: Calculation, Financial Statement (Peter Gratzfeld)**
contract award estimate, project costing, unit cost, target costs, cost center accounting, cost recording, hourly rates, asset accounting, profit and loss statement

**AFI9: Governance (Peter Gratzfeld)**
principles of governance (accountability, responsibility, transparency, fairness), leadership (technical, commercial), reviews, boards, audits, codetermination, compliance

**Workload**

Regular attendance:15 hours

Self-study:15 hours

Exam and preparation:30 hours

**Literature**

All slides are available for download (Ilias-platform).

## T 3.105 Course: Entrepreneurship [T-WIWI-102864]

**Responsible:** Prof. Dr. Orestis Terzidis
**Organisation:** KIT Department of Economics and Management
**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2545001 | Entrepreneurship | 2 SWS | Lecture (V) | Terzidis, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 7900002 | Entrepreneurship | | Prüfung (PR) | Terzidis |
| SS 2018 | 7900192 | Entrepreneurship | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900045 | Entrepreneurship | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900084 | Design Thinking (Track 1) | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900215 | Entrepreneurship | | Prüfung (PR) | Terzidis |
| WS 18/19 | 7900229 | Entrepreneurship | | Prüfung (PR) | Terzidis |

**Competence Certificate**
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**
None

**Recommendation**
None

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

### V Entrepreneurship

2545001, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
This lecture, as an obligatory part of the module “Entrepreneurship”, introduces basic concepts of entrepreneurship. It approaches the individual steps of dynamic corporate development. The focus here is the introduction to methods for generating innovative business ideas, the translation of patents into business concepts and general principles of business planning.
Other topics are the design and use of service-oriented information systems for founders, technology management, business model generation and lean startup methods for the implementation of business ideas in the way of controlled experiments in the market.

**Learning Content**
This lecture, as an obligatory part of the module "Entrepreneurship", introduces basic concepts of entrepreneurship. It approaches the individual steps of dynamic corporate development. The focus here is the introduction to methods for generating innovative business ideas, the translation of patents into business concepts and general principles of financial planning.
Other topics are the design and use of service-oriented information systems for founders, technology management, business model generation and lean startup methods for the implementation of business ideas in the way of controlled experiments in the market.

**Workload**
The total workload for this course is approximately 90 hours. For further information see German version.

## T 3.106 Course: Excercises - Fatigue of Welded Components and Structures [T-MACH-109304]

**Responsible:** Dr. Majid Farajian
Prof. Dr. Peter Gumbsch

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 1 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181731 | Fatigue of Welded Components and Structures | 2 SWS | Lecture (V) | Farajian, Gumbsch |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-109304 | Excercises - Fatigue of Welded Components and Structures | | Prüfung (PR) | Gumbsch, Farajian |

**Competence Certificate**
successful solving of all exercises

**Prerequisites**
none

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

### V Fatigue of Welded Components and Structures

2181731, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The lecture gives an introduction to the following topics:

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

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

**Literature**


1. D. Radaj, C.M. Sonsino and W. Fricke, Fatigue assessment of welded joints by local approaches, Second edition.Woodhead Publishing, Cambridge 2006.
2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009

## T 3.107 Course: Exercices - Tribology [T-MACH-109303]

**Responsible:** Prof. Dr. Martin Dienwiebel
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102637 - Schwerpunkt: Tribologie
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Expansion | Version |
|---|---|---|---|---|
| Studienleistung | 0 | Each winter term | 1 terms | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181114 | Tribology | 5 SWS | Lecture / Practice (VÜ) | Dienwiebel, Scherge |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-109303 | Exercices - Tribology | | Prüfung (PR) | Dienwiebel |

**Competence Certificate**
successful solving of all exercises

**Prerequisites**
none

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

### V Tribology
2181114, WS 18/19, 5 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**

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

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

**Workload**
regular attendance: 45 hours
self-study: 195 hours

**Literature**


1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

## T 3.108 Course: Exercises for Applied Materials Simulation [T-MACH-107671]

| | |
|---|---|
| **Responsible:** | Prof. Dr. Peter Gumbsch<br>Dr. Katrin Schulz |
| **Organisation:** | KIT Department of Mechanical Engineering |
| **Part of:** | M-MACH-102597 - Wahlpflichtmodul Maschinenbau |

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182614 | Applied Materials Modelling | 4 SWS | Lecture / Practice (VÜ) | Schulz, Gumbsch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107671 | Exercises for Applied Materials Simulation | | Prüfung (PR) | Schulz |
| WS 18/19 | 76-T-MACH-107671 | Exercises for Applied Materials Simulation | | Prüfung (PR) | Gumbsch, Schulz |

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

### V Applied Materials Modelling

2182614, SS 2018, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

black board, beamer, script, computer exercise

**Learning 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.

**Workload**
regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

**Literature**

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

## T 3.109 Course: Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-107669]

**Responsible:** Prof. Dr. Hans Jürgen Seifert
**Organisation:** KIT Department of Mechanical Engineering
**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2193005 | Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte | 1 SWS | Practice (Ü) | Seifert, Smyrek, Ziebert, Rank |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107669 | Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | | Prüfung (PR) | Seifert |
| WS 18/19 | 76-T-MACH-107669 | Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | | Prüfung (PR) | Seifert |

**Competence Certificate**
successful participation

**Prerequisites**
none

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

### V Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte
2193005, WS 18/19, 1 SWS, Open in study portal

**Practice (Ü)**

**Learning Content**
1. Ternary phase diagrams

- Complete solubility

- Eutectic systems

2. Thermodynamics of solution phases

3. Materials reactions involving pure condensed phases and a gaseous phase

4. Reaction equilibria in systems containing components in condensed solutions

**Workload**
regular attendance: 14 hours

self-study: 46 hours

**Literature**
1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)

2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

# T 3.110 Course: Exercises for Materials Characterization [T-MACH-107685]

**Responsible:** Dr.-Ing. Jens Gibmeier
**Organisation:** KIT Department of Mechanical Engineering
**Part of:** M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2174586 | Werkstoffanalytik | 2 SWS | Lecture (V) | Schneider, Gibmeier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107685 | Exercises for Materials Characterization | | Prüfung (PR) | Heilmaier, Gibmeier |
| WS 18/19 | 76-T-MACH-107685 | Exercises for Materials Characterization | | Prüfung (PR) | Heilmaier, Gibmeier |

**Competence Certificate**
Regular attendance

**Prerequisites**
none

## T 3.111 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2193004 | Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion | 1 SWS | Practice (Ü) | Franke, Rank, Ziebert |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107632 | Exercises for Solid State Reactions and Kinetics of Phase Transformations | | Prüfung (PR) | Seifert |
| WS 18/19 | 76-T-MACH-107632 | Exercises for Solid State Reactions and Kinetics of Phase Transformations | | Prüfung (PR) | Seifert, Franke |

**Competence Certificate**
successful participation

**Prerequisites**
none

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

## V Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion

**Practice (Ü)**

2193004, WS 18/19, 1 SWS, Open in study portal

**Learning Content**
1. Fick's laws of diffusion
2. Calculation of diffusion coefficients
3. Diffusion and solidification

**Workload**
regular attendance: 14 hours

self-study: 46 hours

**Literature**
Lecture notes

## T 3.112 Course: Experimental Dynamics [T-MACH-105514]

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

**Part of:** M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162225 | Experimental Dynamics | 3 SWS | Lecture (V) | Fidlin |
| SS 2018 | 2162228 | Übungen zu Experimentelle Dynamik | 2 SWS | Practice (Ü) | Fidlin, Burgert |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105514 | Experimental Dynamics | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105514 | Experimental Dynamics | | Prüfung (PR) | Fidlin |

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

**Prerequisites**
Can not be combined with Practical Training in Measurement of Vibrations (T-MACH-105373).

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105373 - Practical Training in Measurement of Vibrations must not have been started.

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

### V Experimental Dynamics
2162225, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. Introduction
2. Measurement principles
3. Sensors as coopled multi-physical systems
4. Digital signal processing, measurements in frequency domain
5. Forced non-linear vibrations
6. Stability problems (Mathieu oscillator, friction induces vibrations)
7. Elementary rotor dynamics
8. Modal analysis

**Annotation**
The lectures will be accompanied by the laboratory experiments

**Workload**
time of attendance: 29 h
self-study: 121 h

## T 3.113 Course: Experimental Fluid Mechanics [T-MACH-105512]

**Responsible:** Dr. Jochen Kriegseis
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154446 | Experimental Fluid Mechanics | 2 SWS | Lecture (V) | Kriegseis |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105512 | Experimental Fluid Mechanics | | Prüfung (PR) | Kriegseis |
| WS 18/19 | 76-T-MACH-105512 | Experimental Fluid Mechanics | | Prüfung (PR) | |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none

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

### V Experimental Fluid Mechanics
2154446, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Slides, chalk board, overhead

**Learning 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

**Workload**
regular attendance: 19,5 hours
self-study: 100,5 hours

**Literature**
Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Spurk, J.H.:Fluid Mechanics, Springer, 1997

## T 3.114 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-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173560 | Welding Lab Course, in groupes | 3 SWS | Practical course (P) | Dietrich, Schulze |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102099 | Experimental Lab Class in Welding Technology, in Groups | | Prüfung (PR) | Heilmaier, Dietrich |
| WS 18/19 | 76-T-MACH-102099 | Experimental Lab Class in Welding Technology, in Groups | | Prüfung (PR) | Heilmaier, Dietrich |

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

**Prerequisites**
Certtificate of attendance for Welding technique (The participation in the course Welding Technology I/II is assumed.).

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

You need sturdy shoes and long clothes!

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

### V Welding Lab Course, in groupes

2173560, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Notes**
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!

**Learning Content**
Gas welding of steels with different weld geometries

Gas welding of cast iron, nonferrous metals

Brazing of aluminum

Electric arc welding with different weld geometries

Gas welding according to the TIG, MIG and MAG procedures

**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!

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

**Literature**
distributed during the lab attendance

# 3.115 Course: Experimental techniques in thermo- and fluid-dynamics [T-MACH-106373]

**Responsible:** Prof. Dr.-Ing. Xu Cheng
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190920 | Experimental Techniques in thermo- and fluid-dynamics | 2 SWS | Lecture (V) | Cheng |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106373 | Experimental techniques in thermo- and fluid-dynamics | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-106373 | Experimental techniques in thermo- and fluid-dynamics | | Prüfung (PR) | Cheng |

**Competence Certificate**
oral exam, duration 20 min

**Prerequisites**
none

# T 3.116 Course: Fabrication Processes in Microsystem Technology [T-MACH-102166]

**Responsible:** Dr. Klaus Bade
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2143882 | Fabrication Processes in Microsystem Technology | 2 SWS | Lecture (V) | Bade |
| WS 18/19 | 2143882 | Fabrication Processes in Microsystem Technology | 2 SWS | Lecture (V) | Bade |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102166 | Fabrication Processes in Microsystem Technology | | Prüfung (PR) | Bade |
| WS 18/19 | 76-T-MACH-102166 | Fabrication Processes in Microsystem Technology | | Prüfung (PR) | Bade |

**Competence Certificate**
Oral examination, 20 minutes

**Prerequisites**
none

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

## V Fabrication Processes in Microsystem Technology

2143882, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

pdf files of presentation sheets

**Learning Content**
The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included

**Literature**
M. Madou
Fundamentals of Microfabrication

CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul

Mikrosystemtechnik für Ingenieure

Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

V

## Fabrication Processes in Microsystem Technology

2143882, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

pdf files of presentation sheets

**Learning 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
2$^{nd}$ Edition, ACS, Washington DC, 1994

# T 3.117 Course: Failure Analysis [T-MACH-105724]

**Responsible:** Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2182572 | Failure Analysis | 2 SWS | Lecture (V) | Greiner, Schneider |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105724 | Failure Analysis | | Prüfung (PR) | Schneider |
| WS 18/19 | 76-T-MACH-105724 | Failure Analysis | | Prüfung (PR) | Schneider |

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

**Prerequisites**
none

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

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

## V Failure Analysis

2182572, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**


1. G. Lange: Systematische Beurteilung technischer Schadensfälle, 6. Auflage, WILEY-VCH Verlag, 2014, ISBN 978-3-527-68316-1, In der KIT-BIB online verfügbar!
2. A. Neidel, et al.: Handbuch Metallschäden -- REM-Atlas und Fallbeispiele zur Ursachenanalyse und Vermeidung, 2. Auflage, Hanser Verlag, 2011, ISBN 978-3-446-42966-6
3. J. Grosch, et al.: Schadenskunde im Maschinenbau: Charakteristische Schadensursachen – Analyse und Aussagen von Schadensfällen, 6. Auflage, Expert-Verlag, 2014, ISBN 978-3-816-93172-0
4. E. Wendler-Kalsch, H. Gräfen: Korrosionsschadenkunde, Springer-Verlag, 1998, ISBN 3-540-63377-4

## T 3.118 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181711 | Failure of structural materials: deformation and fracture | 3 SWS | Lecture / Practice (VÜ) | Gumbsch, Weygand |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | | Prüfung (PR) | Kraft, Weygand, Gumbsch |
| WS 18/19 | 76-T-MACH-102140 | Failure of Structural Materials: Deformation and Fracture | | Prüfung (PR) | Weygand, Gumbsch, Kraft |

**Competence Certificate**
oral exam ca. 30 minutes

no tools or reference materials

**Prerequisites**
none

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

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

### V Failure of structural materials: deformation and fracture

2181711, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**

1. Introduction
2. linear elasticity
3. classification of stresses
4. Failure due to plasticity
    - tensile test
    - dislocations
    - hardening mechanisms
    - guidelines for dimensioning
5. composite materials
6. fracture mechanics
    - hypotheses for failure
    - linear elasic fracture mechanics
    - crack resitance
    - experimental measurement of fracture toughness
    - defect measurement
    - crack propagation
    - application of fracture mechanics
    - atomistics of fracture

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

**Literature**

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); worth reading, relatively simple but comprehensive
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); classic on the mechanical behavior of materials, extensive and good
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relatively simple but yet comprehensive overview of metallic materials

## T 3.119 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181715 | Failure of Structural Materials: Fatigue and Creep | 2 SWS | Lecture (V) | Gruber, Gumbsch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | | Prüfung (PR) | Gruber, Kraft, Gumbsch |
| WS 18/19 | 76-T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | | Prüfung (PR) | Kraft, Gumbsch, Gruber |

**Competence Certificate**
oral exam ca. 30 minutes

no tools or reference materials

**Prerequisites**
none

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

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

### V Failure of Structural Materials: Fatigue and Creep — Lecture (V)
2181715, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
1 Fatigue
1.1 Introduction
1.2 Statistical Aspects
1.3 Lifetime
1.4 Fatigue Mechanisms
1.5 Material Selection
1.6 Thermomechanical Loading
1.7 Notches and Shape Optimization
1.8 Case Study: ICE-Desaster

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

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

**Literature**

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); worth reading, relatively simple but comprehensive
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); classic on the mechanical behavior of materials, extensive and good
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relatively simple but yet comprehensive overview of metallic materials
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); standard work on fatigue, all classes of materials, extensive, for beginners and advanced student

## T 3.120 Course: Fatigue of Metallic Materials [T-MACH-105354]

**Responsible:** Dr. Karl-Heinz Lang
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173585 | Fatigue of Metallic Materials | 2 SWS | Lecture (V) | Lang |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105354 | Fatigue of Metallic Materials | | Prüfung (PR) | Lang |
| WS 18/19 | 76-T-MACH-105354 | Fatigue of Metallic Materials | | Prüfung (PR) | Lang |

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

**Prerequisites**
none

**Recommendation**
Basic knowledge in Materials Science will be helpful.

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

### V Fatigue of Metallic Materials
2173585, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**
Lecture notes that include a list of current literature
will be distributed.

# T 3.121 Course: Fatigue of Welded Components and Structures [T-MACH-105984]

**Responsible:** Dr. Majid Farajian
Prof. Dr. Peter Gumbsch

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181731 | Fatigue of Welded Components and Structures | 2 SWS | Lecture (V) | Farajian, Gumbsch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105984 | Fatigue of Welded Components and Structures | | Prüfung (PR) | Farajian, Gumbsch |
| WS 18/19 | 76-T-MACH-105984 | Fatigue of Welded Components and Structures | | Prüfung (PR) | Farajian, Gumbsch |

**Competence Certificate**
oral examination (ca. 30 min)

no tools or reference materials

**Prerequisites**
admission to the exam only with successful completion of the exercises [T-MACH-109304]

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-109304 - Excercises - Fatigue of Welded Components and Structures must have been passed.

**Recommendation**
preliminary knowlegde materials science and mechanics

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

## V Fatigue of Welded Components and Structures

2181731, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The lecture gives an introduction to the following topics:

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

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

**Literature**

1. D. Radaj, C.M. Sonsino and W. Fricke, Fatigue assessment of welded joints by local approaches, Second edition.Woodhead Publishing, Cambridge 2006.
2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009

## T 3.122 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-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2183716 | FEM Workshop -- Constitutive Laws | 2 SWS | Block lecture (BV) | Schulz, Weygand |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105392 | FEM Workshop - Constitutive Laws | | Prüfung (PR) | Weygand, Schulz |
| WS 18/19 | 76-T-MACH-105392 | FEM Workshop - Constitutive Laws | | Prüfung (PR) | Schulz, Weygand |

### Competence Certificate
solving of a FEM problem

preparation of a report

preparation of a short presentation

### Prerequisites
none

### Recommendation
Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials

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

## V FEM Workshop -- Constitutive Laws
2183716, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

### Learning 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.

### Workload
regular attendance: 28 hours
Self-study: 92 hours

### Literature
Peter Haupt: Continuum Mechanics and Theory of Materials, Springer; ABAQUS Manual; Lecture notes

# T 3.123 Course: Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems [T-MACH-105391]

**Responsible:** Prof. Dr. Claus Günther

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153405 | Finite Difference Methods for numerial solution of thermal and fluid dynamical problems | 2 SWS | Lecture (V) | Günther |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105391 | Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems | | Prüfung (PR) | Günther |
| WS 18/19 | 76-T-MACH-105391 | Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems | | Prüfung (PR) | Günther |

**Competence Certificate**
oral exam, Duration: 30 minutes

no auxiliary means

**Prerequisites**
none

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

## V Finite Difference Methods for numerial solution of thermal and fluid dynamical problems

**Lecture (V)**

2153405, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
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

**Workload**
regulare attendance: 21h

self-study: 100h

## T 3.124 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-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182731 | Finite Element Workshop | 2 SWS | Block lecture (BV) | Weygand, Mattheck, Tesari |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105417 | Finite Element Workshop | | Prüfung (PR) | Weygand |
| WS 18/19 | 76-T-MACH-105417 | Finite Element Workshop | | Prüfung (PR) | Weygand |

**Competence Certificate**
attendance certificate for participation in all course dates

**Prerequisites**
none

**Recommendation**
Continuum Mechanics

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

### V Finite Element Workshop
2182731, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**
The students will learn the foundations of the FEM stress analysis and the optimization methode 'Zugdreiecke'.

**Workload**
regular attendance: 22,5 hours

## T 3.125 Course: Finite Volume Methods for Fluid Flow [T-MACH-105394]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154431 | Finite Volume Methods for Fluid Flow | 2 SWS | Lecture (V) | Günther |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105394 | Finite Volume Methods for Fluid Flow | | Prüfung (PR) | Günther |
| WS 18/19 | 76-T-MACH-105394 | Finite Volume Methods for Fluid Flow | | Prüfung (PR) | Günther |

**Competence Certificate**
oral exam, Duration: 30 minutes

no auxiliary means

**Prerequisites**
none

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

### V Finite Volume Methods for Fluid Flow

2154431, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The Finite Volume Method (=FVM) is nowadays of great interest, as it guarantees conservation of all relevant variables and as it can be used on nearly arbitrary meshes. By this it is a fundamental tool for numerical simulation of flows, which plays an ever growing role for construction and engineering and is the basis of several commercial or research codes as CFX, STAR-CCM+, FLUENT or OpenFOAM. The lecture is concerned with all aspects of FVM, mesh generation is also included. Newer developments as CVFEM (control volume based FEM) are described.

- Introduction
- Conservative schemes
- Finite volume method
- Analysis of FVM
- CVFEM as conservative FEM
- FVM for Navier-Stokes Equations
- Basics of mesh generation

**Annotation**
The lecture is recommended for students of mechanical, chemical or electrical engineering and is also of interest for people which are interested in FVM in a context other than fluid flow problems.

**Workload**
regulare attendance: 32 h

self-study: 88 h

# T 3.126 Course: Flow Measurement Techniques [T-MACH-108796]

**Responsible:** Dr. Jochen Kriegseis
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2155425 | Flow Measurement Techniques | 2 SWS | Practical course (P) | Kriegseis |
| WS 18/19 | 2155425 | Flow Measurement Techniques | 2 SWS | Practical course (P) | Kriegseis |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108796 | Flow Measurement Techniques | | Prüfung (PR) | Kriegseis |

**Competence Certificate**
Participation in at least 7 out of 9 events, successful initial colloquium prior to the respective measurements and submission of a significant report after every experiment

**Prerequisites**
none

**Recommendation**
The content of lecture "Experimental Fluid Mechanics" (T-MACH-105512)

## T 3.127 Course: Flow Simulations [T-MACH-105458]

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

**Part of:** M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2154447 | Flow Simulations | 2 SWS | Practical course (P) | Bruzzese, Frohnapfel, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105458 | Flow Simulations | | Prüfung (PR) | Frohnapfel |
| WS 18/19 | 76-T-MACH-105458 | Flow Simulations | | Prüfung (PR) | |

**Competence Certificate**
ungraded homework and colloquium

**Prerequisites**
none

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

### V Flow Simulations
2154447, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Description**
Practical exercises

**Learning Content**
Flow Simulations with OpenFOAM

- grid generation, grid dependency of the solution
- initial and boundary conditions
- stationary and instationary flows
- interpretation of generated data
- turbulence modelling with RANS models
- comparison of laminar and turbulent flows
  - logarithmic wall law
  - heat and momentum transport
- understanding the structure of OpenFOAM and how to extend it for specific applications

**Annotation**
Block course with limited number of participants, registration in the secretary's office required. See details at www.istm.kit.edu

**Workload**
regulare attendance: 30h

self-study: 90h

**Literature**
H. Ferziger, M. Peric, *Computational Methods for Fluid Dynamics*, Springer, 2008

# T 3.128 Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

**Responsible:** Prof. Dr.-Ing. Xu Cheng
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189910 | Flows and Heat Transfer in Energy Technology | 2 SWS | Lecture (V) | Cheng |
| WS 18/19 | 2189911 | Übungen zu 'Strömungen und Wärmeübertragung in der Energietechnik' | 1 SWS | Practice (Ü) | Cheng, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105403 | Flows and Heat Transfer in Energy Technology | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-105403 | Flows and Heat Transfer in Energy Technology | | Prüfung (PR) | Cheng |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

## V Flows and Heat Transfer in Energy Technology

2189910, WS 18/19, 2 SWS, Open in study portal **Lecture (V)**

**Learning Content**

1. collection of sample applications
2. heat transfer and its application
3. convective fluid dynamics and heat transfer
4. thermal radiation and its application
5. special cases

**Workload**
regular attendance: 21 h
self-study: 100 h

**Literature**


- Bahr, H.D., Stephan, K., Wärme- und Stoffübertragung, 3. Auflage Springer Verlag, 1998
- Mueller, U., Zweiphasenströmung, Vorlesungsmanuskript, Februar 2000, TH Karlsruhe
- Mueller, U., Freie Konvektion und Wärmeübertragung, Vorlesungsmanuskript, WS1993/1994, TH Karlsruhe
- W. Oldekop,"Einführung in die Kernreaktor und Kernkraftwerktechnik,"Verlag Karl Thiemig, München, 1975
- Cacuci, D.G., Badea, A.F., Energiesysteme I, Vorlesungsmanuskript, 2006, TH Karlsruhe
- Jones, O.C., Nuclear Reactor Safety Heat Transfer, Hemisphere Verlag, 1981
- Herwig, H., Moschallski, A., Wärmeübertragung, 2. Auflage, Vieweg + Teubner, 2009

# T 3.129 Course: Flows with Chemical Reactions [T-MACH-105422]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153406 | Flows with chemical reactions | 2 SWS | Lecture (V) | Class |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105422 | Flows with Chemical Reactions | | Prüfung (PR) | Class |
| WS 18/19 | 76-T-MACH-105422 | Flows with Chemical Reactions | | Prüfung (PR) | Class |

**Competence Certificate**
oral exam, duration 30 minutes

Auxiliary none

**Prerequisites**
none

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

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

## V Flows with chemical reactions

2153406, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
Black board

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

**Workload**
regulare attendance: 22.5h

self-study: 99h

**Literature**
Lecture

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

## T 3.130 Course: Fluid Mechanics of Turbulent Flows [T-BGU-109581]

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences
**Part of:** M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Expansion | Version |
|---|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 terms | 1 |

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

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

## T 3.131 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2114093 | Fluid Technology | 2 SWS | Lecture (V) | Geimer, Pult |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102093 | Fluid Power Systems | | Prüfung (PR) | Geimer |
| WS 18/19 | 76T-MACH-102093 | Fluid Power Systems | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-102093 | Fluid Power Systems | | Prüfung (PR) | Geimer |

**Competence Certificate**
The assessment consists of a writen exam (90 minutes) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**
none

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

### V Fluid Technology

2114093, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**

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

**Literature**
Scritum for the lecture *Fluidtechnik*
Institute of Vehicle System Technology
downloadable

# T 3.132 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2154401 | Fluid-Structure-Interaction | 2 SWS | Block lecture (BV) | Mühlhausen |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105474 | Fluid-Structure-Interaction | | Prüfung (PR) | Mühlhausen |
| WS 18/19 | 76-T-MACH-105474 | Fluid-Structure-Interaction | | Prüfung (PR) | |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

## V Fluid-Structure-Interaction

2154401, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**

Blackboard, Power Point, prac. exercises

**Learning Content**
The lecture first introduces/recalls the fundamental governing equations that describe fluids and structures. After the characterization of the problem, the relevant equations are discussed and geometry and grid generation are treated. The resulting partial differential equations are transformed into an algebraic set of equations using different DFG and CSD methods and discretization schemes. Different methods for fluid structure coupling are introduced, where the resulting stability problem is treated in detail. Finally, the obtained result is critically examined in terms of errors and inaccuracy and verification and validation procedures are introduced.

The lecture includes an introduction to function of CFG-Programs and Matlab routines that are related to the theoretically discussed approaches.

**Annotation**
Block course with limited number of participants, registration in the secretary's office required.

See details at www.istm.kit.edu

**Workload**
regular attendance: 21.5h

self-studie: 99h

**Literature**
will be introduced during the lecture

## T 3.133 Course: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181720 | Foundations of nonlinear continuum mechanics | 2 SWS | Lecture (V) | Kamlah |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105324 | Foundations of Nonlinear Continuum Mechanics | | Prüfung (PR) | Kamlah |
| WS 18/19 | 76-T-MACH-105324 | Foundations of Nonlinear Continuum Mechanics | | Prüfung (PR) | Gruber |

**Competence Certificate**
oral exam

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

### V Foundations of nonlinear continuum mechanics

2181720, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

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

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

**Literature**
lecture notes

## T 3.134 Course: Foundry Technology [T-MACH-105157]

**Responsible:** Dr.-Ing. Christian Wilhelm
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2174575 | Foundry Technology | 2 SWS | Lecture (V) | Wilhelm |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105157 | Foundry Technology | | Prüfung (PR) | Wilhelm |
| WS 18/19 | 76-T-MACH-105157 | Foundry Technology | | Prüfung (PR) | Wilhelm |

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

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

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

### V Foundry Technology
2174575, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
The workload for the lecture Foundry Technology is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

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

## T 3.135 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133108 | Fuels and Lubricants for Combustion Engines | 2 SWS | Lecture (V) | Kehrwald |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105184 | Fuels and Lubricants for Combustion Engines | | Prüfung (PR) | Kehrwald |
| WS 18/19 | 76-T-MACH-105184 | Fuels and Lubricants for Combustion Engines | | Prüfung (PR) | |

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

**Prerequisites**
none

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

### V Fuels and Lubricants for Combustion Engines

2133108, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

**Workload**
regular attendance: 24 hours
self-study: 96 hours

**Literature**
Lecturer notes

# T 3.136 Course: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

**Responsible:** Horst Dietmar Bardehle
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113814 | Fundamentals for Design of Motor-Vehicles Bodies I | 1 SWS | Lecture (V) | Bardehle |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | | Prüfung (PR) | Bardehle, Unrau |
| WS 18/19 | 76-T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | | Prüfung (PR) | Unrau, Bardehle |

**Competence Certificate**
Oral group examination

Duration: 30 minutes

Auxiliary means: none

**Prerequisites**
none

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

## V Fundamentals for Design of Motor-Vehicles Bodies I
2113814, WS 18/19, 1 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technologie

6. Body in white / body production, body surface

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

## T 3.137 Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

**Responsible:** Horst Dietmar Bardehle
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114840 | Fundamentals for Design of Motor-Vehicles Bodies II | 1 SWS | Lecture (V) | Bardehle |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102119 | Fundamentals for Design of Motor-Vehicle Bodies II | | Prüfung (PR) | Bardehle, Gauterin |
| WS 18/19 | 76-T-MACH-102119 | Fundamentals for Design of Motor-Vehicle Bodies II | | Prüfung (PR) | Bardehle |

**Competence Certificate**
Oral group examination

Duration: 30 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Fundamentals for Design of Motor-Vehicles Bodies II
2114840, SS 2018, 1 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

## T 3.138 Course: Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-107670]

**Responsible:** Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2193002 | Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria (with exercises) | 3 SWS | Lecture (V) | Seifert |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107670 | Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | | Prüfung (PR) | Seifert |
| WS 18/19 | 76-T-MACH-107670 | Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria | | Prüfung (PR) | Seifert |

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

**Prerequisites**
The successful participation in Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria is the condition for the admittance to the oral exam in Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-107669 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria must have been passed.

**Recommendation**
Bacic course in materials science and engineering

Basic course in mathematics

physics or physical chemistry

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

### V Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria (with exercises)

**Lecture (V)**

2193002, WS 18/19, 3 SWS, Open in study portal

**Learning Content**

1. Binary phase diagrams

2. Ternary phase diagrams

- Complete solubility
- Eutectic systems
- Peritectic systems
- Systems with transition reactions
- Systems with intermetallic phases

3. Thermodynamics of solution phases

4. Materials reactions involving pure condensed phases and a gaseous phase

5. Reaction equilibria in systems containing components in condensed solutions

6. Thermodynamics of multicomponent multiphase materials systems

7. Calculation of Phase Diagrams (CALPHAD)

**Workload**

regular attendance: 22 hours

self-study: 98 hours

**Literature**

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)

2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

# T 3.139 Course: Fundamentals in the Development of Commercial Vehicles I [T-MACH-105160]

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

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113812 | Fundamentals in the Development of Commercial Vehicles I | 1 SWS | Lecture (V) | Zürn |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105160 | Fundamentals in the Development of Commercial Vehicles I | | Prüfung (PR) | Zürn |
| WS 18/19 | 76-T-MACH-105160 | Fundamentals in the Development of Commercial Vehicles I | | Prüfung (PR) | Zürn |

**Competence Certificate**
Oral group examination

Duration: 30 minutes

Auxiliary means: none

**Prerequisites**
none

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

## V Fundamentals in the Development of Commercial Vehicles I

2113812, WS 18/19, 1 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**

1. Marwitz, H., Zittel, S.: ACTROS -- die neue schwere Lastwagenbaureihe von Mercedes-Benz, ATZ 98, 1996, Nr. 9

2. Alber, P., McKellip, S.: ACTROS -- Optimierte passive Sicherheit, ATZ 98, 1996

3. Morschheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.

## T 3.140 Course: Fundamentals in the Development of Commercial Vehicles II [T-MACH-105161]

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

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114844 | Fundamentals in the Development of Commercial Vehicles II | 1 SWS | Lecture (V) | Zürn |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105161 | Fundamentals in the Development of Commercial Vehicles II | | Prüfung (PR) | Zürn |
| WS 18/19 | 76-T-MACH-105161 | Fundamentals in the Development of Commercial Vehicles II | | Prüfung (PR) | Zürn |

**Competence Certificate**
Oral group examination

Duration: 30 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Fundamentals in the Development of Commercial Vehicles II

2114844, SS 2018, 1 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**

1. Schittler, M., Heinrich, R., Kerschbaum, W.: Mercedes-Benz Baureihe 500 -- neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff., 1996

2. Robert Bosch GmbH (Hrsg.): Bremsanlagen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994

3. Rubi, V., Strifler, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Industrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

## T 3.141 Course: Fundamentals of Automobile Development I [T-MACH-105162]

**Responsible:** Dipl.-Ing. Rolf Frech
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113810 | Fundamentals of Automobile Development I | 1 SWS | Lecture (V) | Frech |
| WS 18/19 | 2113851 | Principles of Whole Vehicle Engineering I | 1 SWS | Lecture (V) | Frech |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105162 | Fundamentals of Automobile Development I | | Prüfung (PR) | Frech, Unrau |
| WS 18/19 | 76-T-MACH-105162 | Fundamentals of Automobile Development I | | Prüfung (PR) | Frech, Unrau |

**Competence Certificate**
Written examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Fundamentals of Automobile Development I

2113810, WS 18/19, 1 SWS, Open in study portal

**Lecture (V)**

**Notes**
Block lecture on two days. Room and data will be published on the homepage of the institute.

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
The scriptum will be provided during the first lessons

### V Principles of Whole Vehicle Engineering I

2113851, WS 18/19, 1 SWS, Open in study portal

**Lecture (V)**

**Notes**
Block lecture on two days. Room and data will be published on the homepage of the institute.

In English language.

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
The scriptum will be provided during the first lessons

## T 3.142 Course: Fundamentals of Automobile Development II [T-MACH-105163]

**Responsible:** Dipl.-Ing. Rolf Frech
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 2 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114842 | Fundamentals of Automobile Development II | 1 SWS | Lecture (V) | Frech |
| SS 2018 | 2114860 | Principles of Whole Vehicle Engineering II | 1 SWS | Block lecture (BV) | Frech |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105163 | Fundamentals of Automobile Development II | | Prüfung (PR) | Frech, Unrau |
| WS 18/19 | 76-T-MACH-105163 | Fundamentals of Automobile Development II | | Prüfung (PR) | Unrau, Frech |

**Competence Certificate**
Written examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Fundamentals of Automobile Development II

2114842, SS 2018, 1 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
The scriptum will be provided during the first lessons.

### V Principles of Whole Vehicle Engineering II

2114860, SS 2018, 1 SWS, Open in study portal

**Block lecture (BV)**

**Learning 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

**Workload**
regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**
The scriptum will be provided during the first lessons.

## T 3.143 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

**Responsible:** Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Dr.-Ing. Heiko Kubach
Prof. Dr.-Ing. Egbert Lox

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2134138 | Fundamentals of catalytic exhaust gas aftertreatment | 2 SWS | Lecture (V) | Lox, Grunwaldt, Deutschmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | | Prüfung (PR) | Lox |
| WS 18/19 | 76-T-MACH-105044 | Fundamentals of Catalytic Exhaust Gas Aftertreatment | | Prüfung (PR) | |

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

**Prerequisites**
none

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

### V Fundamentals of catalytic exhaust gas aftertreatment

**Lecture (V)**

2134138, SS 2018, 2 SWS, Open in study portal

**Learning Content**
1. kind and source of emissions
2. emission legislation
3. principal of catalytic exhaust gas aftertreatment (EGA)
4. EGA at stoichiometric gasoline engines
5. EGA at gasoline engines with lean mixtures
6. EGA at diesel engines
7. economical basic conditions for catalytic EGA

**Workload**
regular attendance: 36 hours
self-study: 84 hours

**Literature**
Lecture notes available in the lectures

1. "Environmental Catalysis" Edited by G.Ertl, H. Knötzinger, J. Weitkamp Wiley-VCH Verlag GmbH, Weinheim, 1999 ISBN 3-527-29827-4
2. "Cleaner Cars- the history and technology of emission control since the 1960s" J. R. Mondt Society of Automotive Engineers, Inc., USA, 2000 Publication R-226, ISBN 0-7680-0222-2
3. "Catalytic Air Pollution Control - commercial technology" R. M. Heck, R. J. Farrauto John Wiley & Sons, Inc., USA, 1995 ISBN 0-471-28614-1
4. "Automobiles and Pollution" P. Degobert Editions Technic, Paris, 1995 ISBN 2-7108-0676-2
5. "Reduced Emissions and Fuel Consumption in Automobile Engines" F. Schaeder, R. van Basshuysen, Springer Verlag Wien New York, 1995 ISBN 3-211-82718-8
6. "Autoabgaskatalysatoren : Grudlagen - Herstellung - Entwicklung - Recycling - Ökologie" Ch. Hagelüken und 11 Mitautoren, Expert Verlag, Renningen, 2001 ISBN 3-8169-1932-4

## T 3.144 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133123 | Fundamentals of Combustion Engine Technology | 2 SWS | Lecture (V) | Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105652 | Fundamentals of Combustion Engine Technology | | Prüfung (PR) | Kubach |
| WS 18/19 | 76-T-MACH-105652 | Fundamentals of Combustion Engine Technology | | Prüfung (PR) | Kubach |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none

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

### V Fundamentals of Combustion Engine Technology
2133123, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Fundamentals of engine processes

Components of combustion engines

Mixture formation systems

Gasexchange systems

Injection systems

Engine Control units

Cooling systems

Transmission

**Workload**
regular attendance 25 h

self-study 125 h

# T 3.145 Course: Fundamentals of Combustion I [T-MACH-105213]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2165515 | Fundamentals of Combustion I | 2 SWS | Lecture (V) | Maas |
| WS 18/19 | 2165517 | Fundamentals of Combustion I (Tutorial) | 1 SWS | Practice (Ü) | Maas |
| WS 18/19 | 3165016 | Fundamentals of Combustion I | 2 SWS | Lecture (V) | Maas, Sommerer |
| WS 18/19 | 3165017 | Fundamentals of Combustion I (Tutorial) | 1 SWS | Practice (Ü) | Maas, Sommerer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105213 | Fundamentals of Combustion I | | Prüfung (PR) | Maas |
| SS 2018 | 76-T-MACH-105464 | Fundamentals of Combustion I | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105213 | Fundamentals of Combustion I | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105464 | Fundamentals of Combustion I | | Prüfung (PR) | Maas |

**Competence Certificate**
Written exam, 3 h

**Prerequisites**
none

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

## V Fundamentals of Combustion I

2165515, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Blackboard and Powerpoint presentation

**Learning Content**

- Ignition processes
- Fundamental concepts ans phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames

**Annotation**
Compulsory elective subject: 2+1 SWS and 5 LP.

**Workload**
Regular attendance: 22.5 h

Self-study: 97.5 h

**Literature**
Lecture notes,

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, authors: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

| V | **Fundamentals of Combustion I (Tutorial)**<br>2165517, WS 18/19, 1 SWS, Open in study portal | **Practice (Ü)** |
|---|---|---|

**Literature**

- Lecture Notes
- J. Warnatz; U. Maas; R.W. Dibble: Combustion, Springer, Heidelberg 1996

# T 3.146 Course: Fundamentals of Combustion II [T-MACH-105325]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2100002 | Fundamentals of combustion II | 2 SWS | Lecture (V) | Maas |
| SS 2018 | 2166538 | Fundamentals of combustion II | 2 SWS | Lecture (V) | Maas |
| SS 2018 | 2166539 | Übung zu Grundlagen der technischen Verbrennung II | 1 SWS | Practice (Ü) | Maas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105325 | Fundamentals of Combustion II | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105325 | Fundamentals of Combustion II | | Prüfung (PR) | Maas |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

## V Fundamentals of combustion II

2100002, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Blackboard and Powerpoint presentation

**Learning Content**

- Three dimensional Navier-Stokes equations for reacting flows
- Tubulent reactive flows
- Turbulent non-premixed flames
- Turbulent premixed flames
- Combustion of liquid and solid fuels
- Engine knock
- NOx formation
- Formation of hydrocarbons and soot
- Thermodynamics of combustion processes
- Transport phenomena

**Workload**
Regular attendance: 35 hours

Self-study: 95 hours

**Literature**
Lecture notes;

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation,Experiments, Pollutant Formation; Authors: U. Maas, J. Warnatz, R.W. Dibble, Springer; Heidelberg, Karlsruhe, Berkley 2006

## V Fundamentals of combustion II

2166538, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Blackboard and Powerpoint presentation

**Learning Content**

- Three dimensional Navier-Stokes equations for reacting flows
- Tubulent reactive flows
- Turbulent non-premixed flames
- Turbulent premixed flames
- Combustion of liquid and solid fuels
- Engine knock
- NOx formation
- Formation of hydrocarbons and soot
- Thermodynamics of combustion processes
- Transport phenomena

**Workload**
Regular attendance: 35 hours

Self-study: 95 hours

**Literature**
Lecture notes;

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation,Experiments, Pollutant Formation; Authors: U. Maas, J. Warnatz, R.W. Dibble, Springer; Heidelberg, Karlsruhe, Berkley 2006

## V Übung zu Grundlagen der technischen Verbrennung II

2166539, SS 2018, 1 SWS, Open in study portal

**Practice (Ü)**

**Learning Content**
Calculation and Simulation of combustion processes

**Workload**
regular attendance: 21 hours

**Literature**
Lecture notes
Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

## T 3.147 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-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2130927 | Fundamentals of Energy Technology | 3 SWS | Lecture (V) | Cheng, Badea |
| SS 2018 | 3190923 | Fundamentals of Energy Technology | 3 SWS | Lecture (V) | Badea |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105220 | Fundamentals of Energy Technology | | Prüfung (PR) | Badea, Cheng |
| WS 18/19 | 76-T-MACH-105220 | Fundamentals of Energy Technology | | Prüfung (PR) | Badea, Cheng |

**Competence Certificate**
Written examination, 90 min

**Prerequisites**
none

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

### V Fundamentals of Energy Technology

2130927, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The following relevant fields of the energy industry are covered:
- Energy demand and energy situation
- Energy types and energy mix
- Basics. Thermodynamics relevant to the energy sector
- Conventional fossil-fired power plants
- Combined Cycle Power Plants
- Cogeneration
- Nuclear energy
- Regenerative energies: hydropower, wind energy, solar energy, other energy systems
- Energy demand structures. Basics of economic efficiency and calculus. Optimization
- Energy storage
- Transport of energy
- Power generation and environment. Future of the energy industry

**Workload**
lectures: 45 h

preparation to exam: 195 h

### V Fundamentals of Energy Technology

3190923, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

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

**Workload**

lectures: 45 h
preparation to exam: 195 h

## T 3.148 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-102608 - Schwerpunkt: Kerntechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2190465 | Fundamentals of reactor safety for the operation and dismantling of nuclear power plants | 2 SWS | Block lecture (BV) | Sanchez-Espinoza |

**Competence Certificate**
oral exam about 30 minutes

**Prerequisites**
none

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

### V Fundamentals of reactor safety for the operation and dismantling of nuclear power plants

**Block lecture (BV)**

2190465, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
In the lecture, the fundamental principles and concepts of reactor safety explained. 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 presented in this lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

**Lecture Content:**

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents e.g. the Fukushima accident
- Safety features of reactor systems of generation 3 and 4

**Workload**
**Time of attendance: 30** hours

**Self-study:** 60 hours

**Literature**

- G. Kessler at al; Risks of Nuclear Energy Technology- Safety Concepts of Light Water Reactors. Springer Verlag 2014.
- B. R. Sehgal; Nuclear Safety in LWR: Severe Accident Phenomenology. Academic Press Elsevier. 2012.
- John C. Lee and Norman J. McCormick.July; Risk and Safety Analysis of Nuclear Systems. 2011
- G. Petrangeli; Nuclear Safety. Elsevier Butterworth-Heinemann. 2006
- J. N. Lillington; Light Water Reactor Safety: The Development of Advanced Models and Codes for Light Water Reactor Safety Analysis. Elsevier 1995.

# T 3.149 Course: Fusion Technology A [T-MACH-105411]

**Responsible:** Prof. Dr. Robert Stieglitz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169483 | Fusion Technology A | 2 SWS | Lecture / Practice (VÜ) | Stieglitz |
| WS 18/19 | 2169484 | Übung zu Fusionstechnologie A | 2 SWS | Practice (Ü) | Stieglitz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105411 | Fusion Technology A | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105411 | Fusion Technology A | | Prüfung (PR) | Stieglitz |

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

**Prerequisites**
none

**Recommendation**
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering,

basic knowledge in fluid mechanics, material sciences and physics

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

## V Fusion Technology A
2169483, WS 18/19, 2 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
Acutal energy situation and perspectives. Transfer of the fndamentals in structure of matter physics, fusion and nuclear fission, plasma. Ignition conditions of a plasma, plasma instabilities, control of a plasma and transport in plasmas. Magnet technology, super-conductivity, materials in super-conductivity, fabrication and design of magnets, trtium and fuel cycle, vacuum technology in fusion. The individual section describe additionally the task, the challenges and the design of state of the art technology. Also an introduction into design criteria and materials for fusion are given, which scopes the fundamentals of material science, characterization of fusion materials, material damage by irradiation and calculation methods for nuclear materials.Additionally hints for an adequate material selection are presented.

**Workload**
regular attendance: 21 h
self-study:90 h

**Literature**
Within each subblock an adequate selection of literature is given. Additionally the students get the lecuture materials in printed and electronic version.

# T 3.150 Course: Fusion Technology B [T-MACH-105433]

**Responsible:** Prof. Dr. Robert Stieglitz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190492 | Fusion Technology B | 2 SWS | Lecture (V) | Stieglitz |
| SS 2018 | 2190493 | Übungen zu Fusionstechnologie B | 2 SWS | Practice (Ü) | Stieglitz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105433 | Fusion Technology B | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105433 | Fusion Technology B | | Prüfung (PR) | Stieglitz |

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

**Prerequisites**
none

**Recommendation**
attendance of fusion technology A lecture

reliable capability to use fundamental knowledge communicated in the bachelor study in physics, material sciences , electrical engineering and engineering design

**Annotation**
none

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

## V Fusion Technology B

2190492, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Die Fusionstechnologie B beinhaltet

Fusion neutronics, plasma facing components and plasma heating-and current drive methods. The section fusion neutronics scopes the fundamentals and calculation methods, which allows for a physical design of a nuclear fusion reactor and the corresponding components (such as blankets, divertors, shielding, activation and dose rate). Fusion reactors produce fuel their "self". The necessary blankets are complex structures whose foundations and concept options, design criteria and methods are discussed. Also the divertor is a plasma facing component. Its tasks, constraints, and design concepts are explained. The arrangement of the plasma facing components in a fusion power plant means changing demands on the system integration and energy conversion. To ignite the plasma extreme temperatures of several million degrees are required. For this purpose, special plasma heating techniques are used such as electron cyclotron resonance heating (ECRH), ion-cyclotron resonance heating (ICRH), the current drive at the lower hybrid frequency, and the neutral particle injection. Their basic mode of action, the design criteria, the transmission options and performance are presented and discussed. Additionally the heating method used also for plasma stabilization. Here are some considerations and limitations are presented.

**Workload**
regular attendance: 21 h
self-study: 49 h

**Literature**
Lecture notes

McCracken, Peter Scott, Fusion, The Energy of Universe, Elsevier Academic Press, ISBN: 0-12-481851-X

# T 3.151 Course: Gasdynamics [T-MACH-105533]

**Responsible:** Dr.-Ing. Franco Magagnato
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154200 | Gasdynamics | 2 SWS | Lecture (V) | Magagnato, Xiao |
| WS 18/19 | 2154200 | Gasdynamics | 2 SWS | Lecture (V) | Magagnato |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105533 | Gasdynamics | | Prüfung (PR) | Magagnato |
| WS 18/19 | 76-T-MACH-105533 | Gasdynamics | | Prüfung (PR) | |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none

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

## V Gasdynamics
2154200, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Powerpoint presentation

**Learning Content**
This lecture covers the following topics:

- Introduction, basics of Thermodynamics
- Governing equations of gas dynamics
- Application of the conservation equations
- The transport equations in differential form
- Stationary flow filament theory with and without shock waves
- Discussion of the energy equation: Stagnation and critical values
- Flow filament theory for variable cross-sectional areas. Flow inside a Laval nozzle

**Workload**
regular attendance: 21 hours

self-study: 84 hours

**Literature**
John, J., and Keith T. Gas Dynamics. 3rd ed.

Harlow: Prentice Hall, 2006

Rathakrishnan, E. *Gas Dynamics*. Prentice Hall of India Pvt. Ltd, 2006

## T 3.152 Course: Gear Cutting Technology [T-MACH-102148]

**Responsible:** Dr. Markus Klaiber
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149655 | Gear Cutting Technology | 2 SWS | Lecture (V) | Klaiber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102148 | Gear Cutting Technology | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-102148 | Gear Cutting Technology | | Prüfung (PR) | Schulze |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
none

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

### V Gear Cutting Technology
2149655, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

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

**Learning 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.

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

## T 3.153 Course: Global Production and Logistics - Part 1: Global Production [T-MACH-108848]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149610 | Global Production and Logistics - Part 1: Global Production | 2 SWS | Lecture (V) | Lanza |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108848 | Global Production and Logistics - Part 1: Global Production | | Prüfung (PR) | Lanza |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
"T-MACH-105158 - Globale Produktion und Logistik - Teil 1: Globale Produktion" must not be commenced.

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

### V Global Production and Logistics - Part 1: Global Production

2149610, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

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

**Notes**
Lectures on Mondays 14:00-15:30

**Learning Content**
Target of the lecture is to depict the challenges and fields of action of global operating companies and to give an overview of central aspects in global production networks as well as establishing a deepening knowledge of established methods and procedures for design and scale. Within the course methods for site selection, procedures for site specific adjustment of product construction and product technology as well as planning approaches to establish a new production site are imparted. The course is rounded off by showing the characteristics of the departments sale, procurement as well as research and development under global aspects. Moreover, the implementation of Industry 4.0 applications is discussed in the context of global production.
The topics are:

- Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
- Global sales
- Site selection
- Site specific producion adjustment
- Establishing of new production sites
- Global procurement
- Design and management of global production networks
- Global research and development

**Annotation**
None

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

**Literature**
Lecture Notes
recommended secondary literature:
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008 (english)

## T 3.154 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2149600 | Global Production and Logistics - Part 2: Global Logistics | 2 SWS | Lecture (V) | Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

**Prerequisites**
none

**Recommendation**
We recommend attending the course "Logistics - organization, design and control of logistic systems " (2118078) beforehand.

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

## V Global Production and Logistics - Part 2: Global Logistics

**Lecture (V)**

2149600, SS 2018, 2 SWS, Open in study portal

**Description**
**Media:**

presentations, black board

**Learning 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

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

**Literature**
**Elective literature:**

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

## T 3.155 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113807 | Handling Characteristics of Motor Vehicles I | 2 SWS | Lecture (V) | Unrau |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105152 | Handling Characteristics of Motor Vehicles I | | Prüfung (PR) | Unrau |
| WS 18/19 | 76-T-MACH-105152 | Handling Characteristics of Motor Vehicles I | | Prüfung (PR) | Unrau |

**Competence Certificate**
Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Handling Characteristics of Motor Vehicles I

2113807, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**
1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles I

## T 3.156 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114838 | Handling Characteristics of Motor Vehicles II | 2 SWS | Lecture (V) | Unrau |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105153 | Handling Characteristics of Motor Vehicles II | | Prüfung (PR) | Unrau |
| WS 18/19 | 76-T-MACH-105153 | Handling Characteristics of Motor Vehicles II | | Prüfung (PR) | Unrau |

**Competence Certificate**
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Handling Characteristics of Motor Vehicles II
2114838, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**
1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991
2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R. Unrau, H.-J.: Reprint collection to the lecture Handling Characteristics of Motor Vehicles II

# T 3.157 Course: Hands-on BioMEMS [T-MACH-106746]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2143874 | Hands-on BioMEMS | 2 SWS | Lecture (V) | Guber |
| WS 18/19 | 2143874 | Hands-on BioMEMS | 2 SWS | Lecture (V) | Rajabi, Guber |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106746 | Hands-on BioMEMS | | Prüfung (PR) | Guber |

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

**Prerequisites**
none

## T 3.158 Course: Heat and Mass Transfer [T-MACH-105292]

**Responsible:** Prof. Dr.-Ing. Henning Bockhorn
Prof. Dr. Ulrich Maas

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 3122512 | Heat and Mass Transfer | 2 SWS | Lecture (V) | Bockhorn |
| WS 18/19 | 2165512 | Heat and mass transfer | 2 SWS | Lecture (V) | Maas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105292 | Heat and Mass Transfer | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105292 | Heat and Mass Transfer | | Prüfung (PR) | Maas |

**Competence Certificate**
Written exam, 3 h

**Prerequisites**
none

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

### V Heat and mass transfer

2165512, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Steade stade and non-stready heat transfer in homogenous and compound materials; Plates, pipe sections and sperical shells
- Molecular, equimolecular and unilateral diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heatr transmission in passed through pipes/channesl and circulated around plate and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transmission (ceondensation, evaporation)
- radiative transfer of solid bodies and gases

**Annotation**
Compulsory elective subject: 5 LP

**Workload**
General attendance: 22.5 h

Self-study: 97.5 h

**Literature**

- Bockhorn, H.; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung" , Springer Verlag, 1993
- Incropera, F., DeWitt, F.: "Fundamentals of Heat and Mass Transfer" , John Wiley & Sons, 1996
- Bird, R., Stewart, W., Lightfoot, E.: "Transport Phenomena" , John Wiley & Sons, 1960

## T 3.159 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-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2189907 | Heat Transfer in Nuclear Reactors | 2 SWS | Lecture (V) | Cheng |
| WS 18/19 | 2189907 | Heat Transfer in Nuclear Reactors | 2 SWS | Lecture (V) | Cheng |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105529 | Heat Transfer in Nuclear Reactors | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-105529 | Heat Transfer in Nuclear Reactors | | Prüfung (PR) | Cheng |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

### V Heat Transfer in Nuclear Reactors
2189907, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. Overview of nuclear systems
2. Design tasks and design criteria of nuclear thermal-hydraulics
3. Heat release and distribution in nuclear reactors
4. Heat transfer process in nuclear reactors
5. Temperature distribution in coolant and structural materials
6. Pressure drops in nuclear systems
7. Flow stability of nuclear systems
8. Critical flow under accident conditions
9. Natural circulation and passive safety systems
10. Methodologies of thermal-hydraulic design

**Workload**
**Time of attendance:** 21 hours
**Self-study:** 99 hours

**Literature**

1. W. Oldekop, Einführung in die Kernreaktor und Kernkraftwerkstechnik, Verlag Karl Thiemig, München, 1975
2. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
3. R.T. Lahey, F.J. Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, 2nd edition, ANS, La Grande Park, Illinois, USA, 1993

### V Heat Transfer in Nuclear Reactors
2189907, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. Overview of nuclear systems
2. Design tasks and design criteria of nuclear thermal-hydraulics
3. Heat release and distribution in nuclear reactors
4. Heat transfer process in nuclear reactors
5. Temperature distribution in coolant and structural materials
6. Pressure drops in nuclear systems
7. Flow stability of nuclear systems
8. Critical flow under accident conditions
9. Natural circulation and passive safety systems
10. Methodologies of thermal-hydraulic design

**Workload**
**Time of attendance:** 21 hours
**Self-study:** 99 hours

**Literature**

1. W. Oldekop, Einführung in die Kernreaktor und Kernkraftwerkstechnik, Verlag Karl Thiemig, München, 1975
2. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
3. R.T. Lahey, F.J. Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, 2nd edition, ANS, La Grande Park, Illinois, USA, 1993

# T 3.160 Course: Heatpumps [T-MACH-105430]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2166534 | Heatpumps | 2 SWS | Lecture (V) | Wirbser |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105430 | Heatpumps | | Prüfung (PR) | Wirbser, Maas |
| WS 18/19 | 76-T-MACH-105430 | Heatpumps | | Prüfung (PR) | Maas, Wirbser |

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

**Prerequisites**
none

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

## V Heatpumps

2166534, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

**Workload**
Regular attendance: 21 hours

Self-study: 100 hours

**Literature**
Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

# T 3.161 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-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2183721 | High Performance Computing | 2 SWS | Lecture (V) | Nestler, Selzer, Hötzer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105398 | High Performance Computing | | Prüfung (PR) | Nestler, Selzer |
| WS 18/19 | 76-T-MACH-105398 | High Performance Computing | | Prüfung (PR) | Nestler, Selzer |

**Competence Certificate**
We regularly discuss excercises at the computer.

At the end of the semester, there will be an oral or a written exam.

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

## V High Performance Computing

2183721, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Slides of the lecture, excercise sheets, solution files of the computer excercises.

**Learning Content**
Topics of the high performance computing course are:

- achitectures of parallel platforms
- parallel programming models
- key figures and performance analysis of concurrent programs
- parallelization models
- MPI and OpenMP
- parallel I/O (MPI-I/O)
- vector processing (SIMD)
- cache coherence protocols
- interconnection networks
- simple phase-field models
-

**Workload**
regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

**Literature**

1. Lecture Notes; Problem Sheets; Program templates
2. Foundations of Multithreaded, Parallel, and Distributed Programming, Gregory R. Andrews; Addison Wesley 2000

## T 3.162 Course: High Performance Powder Metallurgy Materials [T-MACH-102157]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2126749 | Advanced powder metals | 2 SWS | Lecture (V) | Schell |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102157 | High Performance Powder Metallurgy Materials | | Prüfung (PR) | Schell |
| WS 18/19 | 76-T-MACH-102157 | High Performance Powder Metallurgy Materials | | Prüfung (PR) | Schell |

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

**Prerequisites**
none

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

### V Advanced powder metals

2126749, SS 2018, 2 SWS, Open in study portal — **Lecture (V)**

**Learning Content**
The lecture gives an overview on production, properties and application of structural and functional powder metallurgy material. The following groups of materials are presented: PM High Speed Steels, Cemented Carbides, PM Metal Matrix Composites, PM Specialities, PM Soft Magnetic and Hard Magnetic Materials.

**Workload**
regular attendance: 22 hours
self-study: 98 hours

**Literature**

- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

## T 3.163 Course: High Temperature Materials [T-MACH-105459]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102649 - Schwerpunkt: Advanced Materials Modelling

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2174600 | High Temperature Structural Materials | 2 SWS | Lecture (V) | Heilmaier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105459 | High Temperature Materials | | Prüfung (PR) | Heilmaier, Lang |
| WS 18/19 | 76-T-MACH-105459 | High Temperature Materials | | Prüfung (PR) | Heilmaier, Lang |

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

**Prerequisites**
none

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

### V High Temperature Structural Materials
2174600, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

**Workload**
Regular attendance 28 h, self study 92 h

**Literature**
M.E. Kassner, Fundamentals of Creep in Metals and Alloys, Elsevier, Amsterdam, 2009

## T 3.164 Course: HoC lectures [T-MACH-106377]

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

**Part of:** M-MACH-102824 - Schlüsselqualifikationen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 2 | Each term | 1 |

**Competence Certificate**
See course

**Prerequisites**
none

## T 3.165 Course: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [T-INFO-101262]

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

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 3 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24678 | Gehirn und Zentrales Nervensystem: Struktur, Informationstransfer, Reizverarbeitung, Neurophysiologie und Therapie | 2 SWS | Lecture (V) | Spetzger |
| WS 18/19 | 24139 | Gehirn und Zentrales Nervensystem: Struktur, Informationstransfer, Reizverarbeitung, Neurophysiologie und Therapie | 2 SWS | Lecture (V) | Spetzger |
| **Exams** | | | | | |
| SS 2018 | 7500145 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | | Prüfung (PR) | Dillmann |
| WS 18/19 | 7500118 | Human Brain and Central Nervous System: Snatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | | Prüfung (PR) | Dillmann |

# T 3.166 Course: Human Factors Engineering I [T-MACH-105518]

**Responsible:** Prof. Dr.-Ing. Barbara Deml
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2109035 | Human Factors Engineering I: Ergonomics | 2 SWS | Lecture (V) | Deml |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105518 | Human Factors Engineering I | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105518 | Human Factors Engineering I | | Prüfung (PR) | Deml |

**Competence Certificate**
written exam, 60 minutes

The exams are only offered in German!

**Prerequisites**
none

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

## V Human Factors Engineering I: Ergonomics

2109035, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Notes**
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, **until 2018/12/06**, on Wednesday and Thursday.

In the second half of the semester, **beginning with 2018/12/12**, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

**Learning Content**

1. Principles of human work
2. Behavioural-science data acquisition
3. workplace design
4. work environment design
5. work management
6. labour law and advocay groups

**Workload**
The amount of work accounts for 120 h (=4 ECTS).

**Literature**
The lecture material is available on ILIAS for download.

# T 3.167 Course: Human Factors Engineering II [T-MACH-105519]

**Responsible:** Prof. Dr.-Ing. Barbara Deml
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2109036 | Human Factors Engineering II: Work Organisation | 2 SWS | Lecture (V) | Deml |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105519 | Human Factors Engineering II | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105519 | Human Factors Engineering II | | Prüfung (PR) | Deml |

**Competence Certificate**
written exam, 60 minutes

The exams are only offered in German!

**Prerequisites**
none

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

## V Human Factors Engineering II: Work Organisation

2109036, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Notes**
The course "Human Factors Engineering II: Work Organisation" takes place in the second half of the semester, **beginning with 2018/12/12**, on Wednesday and Thursday.

In the first half of the semester, **until 2018/12/06**, the course "Human Factors Engineering I: Ergonomics" takes place on Wednesday and Thursday.

**Learning Content**

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

**Workload**
The amount of work is 120 h (=4 ECTS).

**Literature**
The lecture material is available on ILIAS for download.

# T 3.168 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-102600 - Schwerpunkt: Mensch - Technik - Organisation

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110036 | Human Factors Engineering III: Empirical research methods | 2 SWS | Lecture / Practice (VÜ) | Deml |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105830 | Human Factors Engineering III: Empirical research methods | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105830 | Human Factors Engineering III: Empirical research methods | | Prüfung (PR) | Deml |

**Competence Certificate**
Scientific report (about 6 pages), poster, and presentation

**Prerequisites**
In order to attend this lecture, it is necessary having completed "Arbeitswissenschaft I" or "Arbeitswissenschaft II" successfully.

**Modeled Conditions**
You have to fulfill one of 2 conditions:

1. The course T-MACH-105518 - Human Factors Engineering I must have been passed.
2. The course T-MACH-105519 - Human Factors Engineering II must have been passed.

## T 3.169 Course: Human-Machine-Interaction [T-INFO-106257]

**Responsible:** Prof. Dr.-Ing. Michael Beigl
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2400095 | Human-Computer-Interaction | 1 SWS | Practice (Ü) | Beigl, Schankin |
| SS 2018 | 24659 | Human-Computer-Interaction | 2 SWS | Lecture (V) | Beigl, Schankin |
| **Exams** | | | | | |
| SS 2018 | 7500121 | Human-Machine-Interaction | | Prüfung (PR) | Beigl |

## T 3.170 Course: Human-Machine-Interaction [T-INFO-101266]

**Responsible:** Prof. Dr.-Ing. Michael Beigl
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24659 | Human-Computer-Interaction | 2 SWS | Lecture (V) | Beigl, Schankin |
| **Exams** | | | | | |
| SS 2018 | 7500048 | Human-Machine-Interaction | | Prüfung (PR) | Beigl |
| WS 18/19 | 7500076 | Human-Machine-Interaction | | Prüfung (PR) | Beigl |

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-INFO-106257 - Human-Machine-Interaction must have been passed.

## T 3.171 Course: Humanoid Robots - Practical Course [T-INFO-105142]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 24890 | Humanoid Robotics Laboratory | 2 SWS | Practical course (P) | Asfour, Kaiser, Wächter |
| **Exams** | | | | | |
| WS 18/19 | 7500149 | Humanoid Robots - Practical Course | | Prüfung (PR) | Asfour |

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

### V Humanoid Robotics Laboratory

24890, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
In this block course, a complex task will be implemented in a small team. The exercise addresses algorithmic questions in the context of humanoid robotics, such as active perception with stereo or depth cameras, grasping and manipulation planning, action representation with DMS, HMMs or splines, reproduction of motions, or active balancing with humanoid robots.

**Workload**
90 h

# T 3.172 Course: Human-oriented Productivity Management: Personnel Management [T-MACH-106374]

**Responsible:** Dr.-Ing. Patricia Stock
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2109021 | Human-oriented Productivity Management: Personnel Management | 2 SWS | Lecture / Practice (VÜ) | Stock |
| WS 18/19 | 2109021 | Human-oriented Productivity Management: Personnel Management | 2 SWS | Lecture / Practice (VÜ) | Stock |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-106374 | Human-oriented Productivity Management: Personnel Management | | Prüfung (PR) | Deml |

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

The exam is offered in German only!

**Prerequisites**
Timely pre-registration in ILIAS, since participation is limited.

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

## V Human-oriented Productivity Management: Personnel Management — Lecture / Practice (VÜ)
2109021, SS 2018, 2 SWS, Open in study portal

**Annotation**

- Compact course (one week full-time)
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required

**Literature**
Handout and literature is available on ILIAS for download.

## V Human-oriented Productivity Management: Personnel Management — Lecture / Practice (VÜ)
2109021, WS 18/19, 2 SWS, Open in study portal

**Annotation**

- Compact course (one week full-time)
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required

**Literature**
Handout and literature is available on ILIAS for download.

## 3.173 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

**Responsible:** Dr.-Ing. Klaus-Peter Becker
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2306321 | Hybride und elektrische Fahrzeuge | 2 SWS | Lecture (V) | Doppelbauer |
| WS 18/19 | 2306323 | Übungen zu 2306321 Hybride und elektrische Fahrzeuge | 1 SWS | Practice (Ü) | Doppelbauer |
| **Exams** | | | | | |
| SS 2018 | 7306321 | Hybrid and Electric Vehicles | | Prüfung (PR) | Doppelbauer |
| WS 18/19 | 7306321 | Hybrid and Electric Vehicles | | Prüfung (PR) | Doppelbauer |

**Prerequisites**
none

# T 3.174 Course: Hydraulic Fluid Machinery [T-MACH-105326]

**Responsible:** Dr. Balazs Pritz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2157432 | Hydraulic Fluid Machinery | 4 SWS | Lecture (V) | Pritz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105326 | Hydraulic Fluid Machinery | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105326 | Hydraulic Fluid Machinery | | Prüfung (PR) | Gabi |

**Competence Certificate**
oral exam, 40 min.

**Prerequisites**
None.

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

## V Hydraulic Fluid Machinery
2157432, SS 2018, 4 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 56 hours
self-study: 150 hours

preparation for exam: 40 hours

**Literature**

1. Fister, W.: Fluidenergiemaschinen I & II, Springer-Verlag
2. Bohl, W.: Strömungsmaschinen I & II . Vogel-Verlag
3. Gülich, J.F.: Kreiselpumpen, Springer-Verlag
4. Pfleiderer, C.: Die Kreiselpumpen. Springer-Verlag
5. Carolus, T.: Ventilatoren. Teubner-Verlag
6. Kreiselpumpenlexikon. KSB Aktiengesellschaft
7. Zierep, J., Bühler, K.: Grundzüge der Strömungslehre. Teubner-Verlag

## T 3.175 Course: Hydrodynamic Stability: From Order to Chaos [T-MACH-105425]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154437 | Hydrodynamic Stability: From Order to Chaos | 2 SWS | Lecture (V) | Class |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105425 | Hydrodynamic Stability: From Order to Chaos | | Prüfung (PR) | Class |
| WS 18/19 | 76-T-MACH-105425 | Hydrodynamic Stability: From Order to Chaos | | Prüfung (PR) | Class |

### Competence Certificate
oral exam, Duration: 30 minutes

Auxiliary means: none

### Prerequisites
The partial performance number T-MACH-108846 - "Stability: From Order to Chaos" (Nat/Inf/Etit) must not be startet or completed. The partial services T-MACH-108846 - "Stability: From Order to Chaos" (Nat/Inf/Etit) and T-MACH-105425 - "Hydrodynamic Stability: From Order to Chaos" are mutually exclusive.

### Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108846 - Stability: from order to chaos must not have been started.

### Recommendation
Fluid Mechanics (T-MACH-105207)

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

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

### V Hydrodynamic Stability: From Order to Chaos
2154437, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Black board

**Learning Content**
Increasing a control parameter of a thermohydraulic system, e.g. the Reynolds number, the initial flow pattern (e.g. stationary flow) can be replaced by a different pattern (e.g. turbulent flow).

Typical hydrodynamic instabilities are summarized in the lecture.
The systematic analysis of thermohydraulic stability problems is developed for the case of Rayleigh-Bernard convection (fluid layer heated from below) and selected examples from fluid dynamics.

Covered is:

- linear stability analysis: determine limiting control parameter value up to which the basic flow pattern is stable against small perturbations.
- nonlinear reduced order modeling, capable to characterize more complex flow patterns
- Lorenz system: a generic system exhibiting chaotic behavior

**Annotation**
Lecture also offered as a block-lecture within the AREVA Nuclear Professional School (www.anps.kit.edu)

**Workload**
regulare attendance: 21h

self-study: 99h

**Literature**
Script

# T 3.176 Course: Hydrogen in Materials [T-MACH-108853]

**Responsible:** Prof. Dr. Astrid Pundt
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173583 | Hydrogen in Materials | 2 SWS | Lecture (V) | Pundt |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108853 | Hydrogen in Materials | | Prüfung (PR) | Pundt |

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

**Prerequisites**
none

**Recommendation**
Materials Science or Materials Physics and Metals

# T 3.177 Course: Hydrogen Technologies [T-MACH-105416]

**Responsible:** Dr. Thomas Jordan
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2170495 | Hydrogen Technologies | 2 SWS | Lecture (V) | Jordan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105416 | Hydrogen Technologies | | Prüfung (PR) | Jordan |
| WS 18/19 | 76-T-MACH-105416 | Hydrogen Technologies | | Prüfung (PR) | Jordan |

**Competence Certificate**
oral exam, Duration: approximately 30 minutes

Auxiliary: no tools or reference materials may be used during the exam

**Prerequisites**
none

**Recommendation**
Fundamentals Thermodynamics

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

## V Hydrogen Technologies

2170495, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Basic concepts
Production
Transport and storage
Application
Safety aspects

**Annotation**
Recommendation: Fundamentals Thermodynamics

**Workload**
regular attendance: 21 h
self-study: 99 h

**Literature**
Ullmann's Encyclopedia of Industrial Chemistry
Hydrogen and Fuel Cells, Ed. S. Stolten, Wiley-VCH, 2010, ISBN 978-3-527-32711-9

## T 3.178 Course: Ignition systems [T-MACH-105985]

**Responsible:** Dr.-Ing. Olaf Toedter
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Version |
|---|---|---|
| Prüfungsleistung mündlich | 4 | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133125 | Ignition systems | 2 SWS | Lecture (V) | Toedter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105985 | Ignition systems | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105985 | Ignition systems | | Prüfung (PR) | Koch |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

# T 3.179 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153425 | Industrial aerodynamics | 2 SWS | Block lecture (BV) | Breitling |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105375 | Industrial Aerodynamics | | Prüfung (PR) | Breitling |
| WS 18/19 | 7600003 | Industrial Aerodynamics | | Prüfung (PR) | Breitling |
| WS 18/19 | 76-T-MACH-105375 | Industrial Aerodynamics | | Prüfung (PR) | Breitling |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none

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

## V Industrial aerodynamics

2153425, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**

Power Point

**Learning Content**
This compact lecture deals with flow, mixing and combustion phenomena with significance in vehicle development. A special focus is set on the optimization of external car and truck aerodynamics, thermal comfort in passenger compartments, analyses of cooling flows and improvement of charge motion, mixing and combustion in piston engines. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. The focus of this lecture is on industry relevant methods for analyses and description of forces, flow structures, turbulence, flows with heat transfer and phase transition and reactive flows. In addition an introduction to modern methods in accuracy control and efficiency improvement of numerical methods for industrial use is given. The integration and interconnection of the methods in the development processes are discussed examplary.
An excursion to the Daimler AG wind tunnel and the research and development centers is planned.

- Industrial flow measurement techniques
- Flow simulation and control of numerical errors, turbulence modeling
- Cooling flows
- Flow mixing and combustation at direct injected Diesel engines
- Flow mixing and combustation at gasoline engine
- Vehicle aerodynamics
- HVAC-Systems and thermal comfort
- Aeroacoustics

**Annotation**
Block course with limited number of participants, registration in the secretary's office required. See details at www.istm.kit.edu

**Workload**
attendance: 22.5h
self-study: 100h

**Literature**
Script

# T 3.180 Course: Information Engineering [T-MACH-102209]

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

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2122014 | Information Engineering | 2 SWS | Seminar (S) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102209 | Information Engineering | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102209 | Information Engineering | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Alternative exam assessment (written composition and speech)

**Prerequisites**
None

## T 3.181 Course: Information Processing in Mechatronic Systems [T-MACH-105328]

**Responsible:** Prof. Dr.-Ing. Michael Kaufmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102624 - Schwerpunkt: Informationstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105022 | Information Processing in Mechatronic Systems | 2 SWS | Lecture (V) | Kaufmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105328 | Information Processing in Mechatronic Systems | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105328 | Information Processing in Mechatronic Systems | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

### V Information Processing in Mechatronic Systems
2105022, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Information processing components – consisting of sensors, actors, hardware and software – are of essential importance for the implementation of mechatronic functions.

Based on requirements on information processing in mechatronic systems typical hardware and software solutions are examined. Characteristics, advantages, disadvantages and application areas are discussed. Solutions are examined regarding real-time capabilities, dependability, safety and fault tolerance. Bus communication in mechatronic systems is examined. Description methods and several approaches of functional description are considered. An approach on the development of information processing components is developed. Lecture topics are complemented by practical examples.

Outline:

- Requirements on information processing components,
- Characteristics of information processing components
- Real-time capabilities, dependability, safety and fault tolerance
- Architectures of information processing components
- Communication in mechatronic systems
- Descriptive models und functional description
- Development of information processing components

Software quality

**Workload**
General attendance: 21 h

Self-study: 99 h

**Literature**


- Marwedel, P.: Eingebettete Systeme. Springer: 2007.
- Teich, J: Digitale Hard-, Software-Systeme. Springer: 2007.
- Wörn, H., Brinkschulte, U.: Echtzeitsysteme: Grundlagen, Funktionsweisen, Anwendungen. Springer, 2005.
- Zöbel, D.: Echtzeitsysteme: Grundlagen der Planung. Springer, 2008.

## T 3.182 Course: Information Processing in Sensor Networks [T-INFO-101466]

**Responsible:** Prof. Dr.-Ing. Uwe Hanebeck
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102624 - Schwerpunkt: Informationstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Irregular | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 24102 | Information Processing in Sensor Networks | 3 SWS | Lecture (V) | Noack, Mayer, Hanebeck |
| **Exams** | | | | | |
| SS 2018 | 7500011 | Information Processing in Sensor Networks | | Prüfung (PR) | Hanebeck, Noack |
| WS 18/19 | 7500030 | Information Processing in Sensor Networks | | Prüfung (PR) | Noack, Hanebeck |

## T 3.183 Course: Information Systems and Supply Chain Management [T-MACH-102128]

**Responsible:** Dr. Christoph Kilger
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 3 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118094 | Information Systems in Logistics and Supply Chain Management | 2 SWS | Lecture (V) | Kilger |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102128 | Information Systems and Supply Chain Management | | Prüfung (PR) | Mittwollen |
| WS 18/19 | 76T-MACH-102128 | Information Systems and Supply Chain Management | | Prüfung (PR) | Mittwollen |
| WS 18/19 | 76-T-MACH-102128 | Information Systems and Supply Chain Management | | Prüfung (PR) | Mittwollen |

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

### V Information Systems in Logistics and Supply Chain Management
2118094, SS 2018, 2 SWS, Open in study portal — **Lecture (V)**

**Description**
**Media:**

presentations

**Learning Content**
1) Overview of logistics systems and processes

2) Basic concepts of information systems and information technology

3) Introduction to IS in logistics: Overview and applications

4) Detailed discussion of selected SAP modules for logistics support

**Annotation**
none

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

**Literature**
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

# T 3.184 Course: Innovative Nuclear Systems [T-MACH-105404]

**Responsible:** Prof. Dr.-Ing. Xu Cheng
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2130973 | Innovative Nuclear Systems | 2 SWS | Lecture (V) | Cheng |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105404 | Innovative Nuclear Systems | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-105404 | Innovative Nuclear Systems | | Prüfung (PR) | Cheng |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

## V Innovative Nuclear Systems

2130973, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

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

**Workload**
**Time of attendance:** 21 hours
**Self-study:** 100 hours

## T 3.185 Course: Innvative Project [T-MACH-109185]

**Responsible:** Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169466 | Innovative Project | 3 SWS | Project/Seminar (PJ/S) | Class, Terzidis |

**Competence Certificate**
Students have to deliver pitch-talk supported by slides to convience a commity about their results. A fictive project proposal of 10 to 15 pages.

**Prerequisites**
none

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

Recommended English profiency äquivalent to:

- IELTS Academic test
  An overall band score of at least 6.5 (with no section lower than 5.5)
- University of Cambridge
  Certificate in Advanced English, CAE (grades A – C)
  Certificate of Proficiency in English, CPE (grades A – C)
- TOEFL Internet-based test, IBT
  A total score of at least 92, with a minimum score of 22 from the writing section

**Annotation**
The subject of the project is provided by industry partner or the innovation department from KIT or INP Grenoble. Representatives of industry partner will be addressee for the pitch-talk.

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

### V Innovative Project

**Project/Seminar (PJ/S)**

2169466, WS 18/19, 3 SWS, Open in study portal

**Notes**
The lecture will be executed with the partner university INP Grenoble. Participates need to bring there own laptop with Skype installed. Teams of 2-3 students.

**Learning Content**

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.

**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.

**Workload**

approx. 180 hours:

3 credit points - skype participation and resulting in TAS - 90 hours

1 credit point - pitch talk - 30 hours

2 credit points - for writting proposal - 60 hours

## T 3.186 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2121001 | Integrated Information Systems for engineers | 3 SWS | Lecture (V) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102083 | Integrated Information Systems for Engineers | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102083 | Integrated Information Systems for Engineers | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Oral examination 20 min.

**Prerequisites**
None

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

### V Integrated Information Systems for engineers

2121001, SS 2018, 3 SWS, Open in study portal **Lecture (V)**

**Learning Content**

- Information systems, information management
- CAD, CAP and CAM systems
- PPS, ERP and PDM systems
- Knowledge management and ontology
- Process modeling

**Workload**
Regular attendance: 31,5 hours, self-study: 108 hours

**Literature**
Lecture slides

## T 3.187 Course: Integrated Product Development [T-MACH-105401]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Albers Assistenten

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102626 - Schwerpunkt: Integrierte Produktentwicklung

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 16 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2145156 | Integrated Product Development | 4 SWS | Lecture (V) | Albers |
| WS 18/19 | 2145157 | Workshop Product Development | 4 SWS | Practice (Ü) | Albers, Mitarbeiter |
| WS 18/19 | 2145300 | Project Work in Product Development | 2 SWS | Others (sonst.) | Albers |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105401 | Integrated Product Development | | Prüfung (PR) | Albers |
| WS 18/19 | 7600021 | Integrated Product Development | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105401 | Integrated Product Development | | Prüfung (PR) | Albers |

**Competence Certificate**
oral examination (60 minutes)

**Prerequisites**
none

**Annotation**
Due to organizational reasons, the number of participants is limited. Thus a selection has to be made. For registration to the selection process a standard form has to be used, that can be downloaded from IPEK hompage from april to july. The selection itself is made by Prof. Albers in personal interviews.

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

### V Integrated Product Development — Lecture (V)
2145156, WS 18/19, 4 SWS, Open in study portal

**Learning Content**
organizational integration: integrated product engineering model, core team management and simultaneous engineering
informational integration: innovation management, cost management, quality management and knowledge management

personal integration: team coaching and leadership management

invited lectures

**Annotation**
The lecture starts in first week of October.

**Workload**
regular attendance: 84 h
self-study: 288 h

**Literature**
Klaus Ehrlenspiel - Integrierte Produktentwicklung. Denkabläufe, Methodeneinsatz, Zusammenarbeit, Hanser Verlag, 2009

### V Workshop Product Development — Practice (Ü)
2145157, WS 18/19, 4 SWS, Open in study portal

**Learning Content**
problem solving: analysis techniques, creativity techniques and evaluation methods

professional skills: presentation techniques, moderation and teamcoaching

development tools: MS Project, Szenario-Manager & Pro/Engineer Wildfire

**Workload**
lectures: 21 h

preparation to exam: 99 h

**Literature**
none

V **Project Work in Product Development** **Others (sonst.)**
2145300, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
The project work begins with the early stages of product development, i.e. the identification of market trends and needs. Based on this information the students develop scenarios for future markets and create product profiles, which describe the customers and their demands without anticipating possible product solutions. After having passed several following milestones for ideas, concepts and designs, virtual prototypes and function prototypes are presented to an audience.
The project work is supported by coaching through skilled faculty staff. Additionally weekly tutorials, respectively workshops are given. For doing the project the teams gain access to team workspaces featuring IT-infrastructure and relevant software, such as office, CAD or FEA. Further on the teams learn how team cooperation and knowledge management can be supported in design project by using a wiki system.

**Workload**
regular attendance: 21 h

self-study: 99 h

# T 3.188 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-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150660 | Integrated Production Planning in the Age of Industry 4.0 | 6 SWS | Lecture / Practice (VÜ) | Lanza |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108849 | Integrated Production Planning in the Age of Industry 4.0 | | Prüfung (PR) | Lanza |

**Competence Certificate**
Oral Exam (40 min)

**Prerequisites**
"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

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

## V Integrated Production Planning in the Age of Industry 4.0

2150660, SS 2018, 6 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

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

**Learning 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.

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

**Literature**
Lecture Notes

## T 3.189 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-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150601 | Integrative Strategies in Production and Development of High Performance Cars | 2 SWS | Lecture (V) | Schlichtenmayer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105188 | Integrative Strategies in Production and Development of High Performance Cars | | Prüfung (PR) | Lanza |
| WS 18/19 | 76-T-MACH-105188 | Integrative Strategies in Production and Development of High Performance Cars | | Prüfung (PR) | Lanza |

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

**Prerequisites**
none

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

### V Integrative Strategies in Production and Development of High Performance Cars Lecture (V)
2150601, SS 2018, 2 SWS, Open in study portal

**Description**
**Media:**

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

**Learning 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

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

**Literature**
Lecture Slides

# T 3.190 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

**Responsible:** Frank Zacharias
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2147160 | Patente und Patentstrategien in innovativen Unternehmen | 2 SWS | Block lecture (BV) | Zacharias |
| WS 18/19 | 2147161 | Intellectual Property Rights and Strategies in Industrial Companies | 2 SWS | Lecture (V) | Zacharias |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | | Prüfung (PR) | Albers |

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

**Prerequisites**
none

**Recommendation**
None

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

## V Intellectual Property Rights and Strategies in Industrial Companies

**Lecture (V)**

2147161, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
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

**Workload**
regular attendance: 21 h

self-study: 99 h

## T 3.191 Course: Introduction into Mechatronics [T-MACH-100535]

**Responsible:** Moritz Böhland
Dr.-Ing. Maik Lorch
PD Dr.-Ing. Markus Reischl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105011 | Introduction into Mechatronics | 3 SWS | Lecture (V) | Reischl, Lorch, Böhland |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100535 | Introduction into Mechatronics | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-100535 | Introduction into Mechatronics | | Prüfung (PR) | Hagenmeyer |

**Competence Certificate**
Oral exam (Duration: 2h)

**Prerequisites**
none

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

### V Introduction into Mechatronics

2105011, WS 18/19, 3 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
**Part I: Modeling and optimization** (Prof. Bretthauer)

Introduction
Architecture of mechatronic systems
Modeling of mechatronic systems
Optimization of mechatronic systems
Perspective

**Part II: Development and design** (Prof. Albers)

Introduction
Development method for mechatronic products
Examples

**Workload**
regular attendance: 31.5 h
self-study: 148 h

**Literature**

Heimann, B.; Gerth, W.; Popp, K.: Mechatronik. Leipzig: Hanser, 1998
Isermann, R.: Mechatronische Systeme - Grundlagen. Berlin: Springer, 1999
Roddeck, W.: Einführung in die Mechatronik. Stuttgart: B. G. Teubner, 1997
Töpfer, H.; Kriesel, W.: Funktionseinheiten der Automatisierungstechnik. Berlin: Verlag Technik, 1988
Föllinger, O.: Regelungstechnik. Einführung in die Methoden und ihre Anwendung. Heidelberg: Hüthig, 1994
Bretthauer, G.: Modellierung dynamischer Systeme. Vorlesungsskript. Freiberg: TU Bergakademie, 1997

## T 3.192 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162235 | Introduction into the multi-body dynamics | 3 SWS | Lecture (V) | Seemann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105209 | Introduction into the Multi-Body Dynamics | | Prüfung (PR) | Seemann |
| WS 18/19 | 76-T-MACH-105209 | Introduction into the Multi-Body Dynamics | | Prüfung (PR) | Seemann |

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

**Prerequisites**
none

**Recommendation**
Engineering Mechanics III/IV

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

## V Introduction into the multi-body dynamics

**Lecture (V)**

2162235, SS 2018, 3 SWS, Open in study portal

**Learning Content**
The role of multibody systems in engineering, kinematics of a single rigid body, Kinematics of multibody systems, rotation matrix, angular velocity, derivatives in different reference systems, holonomic and non-holonomic constraints, Newton-Euler's equations, principle of d'Alembert, principle of virtuel power, Lagrange's equations, Kane's equations, structure of the equations of motion

**Workload**
time of attendance: 21,5h; self-study: 98h

**Literature**
Wittenburg, J.: Dynamics of Systems of Rigid Bodies, Teubner Verlag, 1977
Roberson, R. E., Schwertassek, R.: Dynamics of Multibody Systems, Springer-Verlag, 1988
de Jal'on, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody System.
Kane, T.: Dynamics of rigid bodies.

# T 3.193 Course: Introduction to Ceramics [T-MACH-100287]

**Responsible:** Prof. Dr. Michael Hoffmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2125757 | Introduction to Ceramics | 3 SWS | Lecture (V) | Hoffmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100287 | Introduction to Ceramics | | Prüfung (PR) | Hoffmann, Schell, Wagner |
| WS 18/19 | 76-T-MACH-100287 | Introduction to Ceramics | | Prüfung (PR) | Hoffmann, Schell, Wagner |

**Competence Certificate**
The assessment consists of an oral exam (30 min) taking place at a specific date.

The re-examination is offered at a specific date.

**Prerequisites**
None

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

## V Introduction to Ceramics

2125757, WS 18/19, 3 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Slides for the lecture:

available under http://www.iam.kit.edu/km

**Learning Content**
After a short introduction to interatomic bonding, fundamental concepts of crystallography, the stereographic projection and the most important symmetry elements will be given. Different types of crystal structures are explained and the relevance of imperfections are analysed with respect to the mechanical and electrical properties of ceramics. Then, the impact of surfaces, interfaces and grain boundaries for the preparation, microstructural evolution and the resulting properties is discussed. Finally, an introduction is given to ternary phase diagrams.

The second part of the course covers structure, preparation and application aspects of nonmetallic inorganic glasses, followed by an introduction to the properties and processing methods of fine-grained technical powders. The most relevant shaping methods, such as pressing, slip casting, injection moulding and extrusion are introduced. Subsequently, the basics of science of sintering and the mechanisms for normal and abnormal grain growth are discussed. Mechanical properties of ceramics are analysed using basic principles of linear elastic fracture mechanics, Weibull statistics, concepts for subcritical crack growth and creep models to explain the behaviour at elevated temperatures. Furthermore it is demonstrated that mechanical properties can be siginificantly enhanced by various types of microstructural toughening mechanisms. The electronic and ionic conductivity of ceramic materials are explained based on defect-chemical considerations and band structure models. Finally, the characteristics of a dielectric, pyroelectric, and piezoelectric behaviour is discussed.

**Workload**
regular attendance: 45 hours
self-study: 135 hours

**Literature**

- H. Salmang, H. Scholze, "Keramik", Springer
- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier

## T 3.194 Course: Introduction to Industrial Production Economics [T-MACH-105388]

**Responsible:** Simone Dürrschnabel
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2109042 | Introduction to Industrial Production Economics | 2 SWS | Lecture (V) | Dürrschnabel |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105388 | Introduction to Industrial Production Economics | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105388 | Introduction to Industrial Production Economics | | Prüfung (PR) | Deml |

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

The exam is offered in German only!

**Prerequisites**
none

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

### V Introduction to Industrial Production Economics
2109042, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Design of structural and process organisation
- Execution and evaluation of time studies
- Actual tools for time studies, e.g. Work Sampling, Methods-Time Measurement, Planned times,
- Evaluation of workplaces and determination of wages
- Cost accounting (including process costs)

**Workload**
The amount of work accounts for 120 h (=4 ECTS).

**Literature**
Handout and literature are available on ILIAS for download.

## T 3.195 Course: Introduction to Microsystem Technology - Practical Course [T-MACH-108312]

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

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2143877 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| WS 18/19 | 2143877 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108312 | Introduction to Microsystem Technology - Practical Course | | Prüfung (PR) | Last |

**Competence Certificate**
non-graded written examination

**Prerequisites**
none

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

### V Introduction to Microsystem Technology - Practical Course
2143877, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

### V Introduction to Microsystem Technology - Practical Course
2143877, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

## T 3.196 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141861 | Introduction to Microsystem Technology I | 2 SWS | Lecture (V) | Korvink, Badilita |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105182 | Introduction to Microsystem Technology I | | Prüfung (PR) | Korvink, Badilita |
| WS 18/19 | 76-T-MACH-105182 | Introduction to Microsystem Technology I | | Prüfung (PR) | Korvink, Badilita |

**Competence Certificate**
written examination for implementation in a major field, 30 min oral exam for elective subject

**Prerequisites**
none

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

### V Introduction to Microsystem Technology I — Lecture (V)
2141861, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
- Introduction in Nano- and Microtechnologies
- Silicon and processes for fabricating microelectronics circuits
- Basic physics background and crystal structure
- Materials for micromachining
- Processing technologies for microfabrication
- Silicon micromachining
- Examples

**Workload**
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

# T 3.197 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142874 | Introduction to Microsystem Technology II | 2 SWS | Lecture (V) | Korvink, Badilita |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105183 | Introduction to Microsystem Technology II | | Prüfung (PR) | Korvink, Badilita |
| WS 18/19 | 76-T-MACH-105183 | Introduction to Microsystem Technology II | | Prüfung (PR) | Korvink, Badilita |

**Competence Certificate**
written examination for major field, oral exam (30 min) for elective field

**Prerequisites**
none

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

## V Introduction to Microsystem Technology II

2142874, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

**Workload**
Literature: 20 h

Lessions: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

## T 3.198 Course: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190490 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | 2 SWS | Lecture (V) | Dagan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105466 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | | Prüfung (PR) | Stieglitz, Dagan |
| WS 18/19 | 76-T-MACH-105466 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | | Prüfung (PR) | Dagan, Stieglitz |

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

**Prerequisites**
none

**Annotation**
none

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

### V Introduction to Neutron Cross Section Theory and Nuclear Data Generation — Lecture (V)
2190490, SS 2018, 2 SWS, Open in study portal

**Learning 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

**Workload**
Regular attendance: 26 h

self study: 94 h

**Literature**
Handbook of Nuclear Reactors Calculations Vol. I Y. Ronen, CRC Press 1986

D. Emendorfer. K.H. Höcker Theory of nuclear reactions, Parts I, II BI- Hochschultaschenbücher 1969 ( in German)

P. Tippler, R. Llewellyn Modern Physics 2008

## T 3.199 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 7 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2162247 | Introduction to Nonlinear Vibrations | 2 SWS | Lecture (V) | Fidlin |
| WS 18/19 | 2162248 | Introduction into the nonlinear vibrations (Tutorial) | 2 SWS | Practice (Ü) | Fidlin, Drozdetskaya |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105439 | Introduction to Nonlinear Vibrations | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105439 | Introduction to Nonlinear Vibrations | | Prüfung (PR) | Fidlin |

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

**Prerequisites**
none

**Recommendation**
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

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

### V Introduction to Nonlinear Vibrations

2162247, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
time of attendance: 39 h
self-study: 201 h

**Literature**


- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Nayfeh A.H., Mook D.T. Nonlinear Oscillation. Wiley, 1979.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.
- Fidlin A. Nonlinear Oscillations in Mechanical Engigeering. Springer, 2005.
- Bogoliubov N.N., Mitropolskii Y.A. Asymptotic Methods in the Theory of Nonlinear Oscillations. Gordon and Breach, 1961.
- Nayfeh A.H. Perturbation Methods. Wiley, 1973.
- Sanders J.A., Verhulst F. Averaging methods in nonlinear dynamical systems. Springer-Verlag, 1985.
- Blekhman I.I. Vibrational Mechanics. World Scientific, 2000.
- Moon F.C. Chaotic Vibrations – an Introduction for applied Scientists and Engineers. John Wiley & Sons, 1987.


**V** **Introduction into the nonlinear vibrations (Tutorial)** **Practice (Ü)**

2162248, WS 18/19, 2 SWS, Open in study portal

**Workload**
time of attendance: 10,5h; self-study: 20h

## T 3.200 Course: Introduction to Nuclear Energy [T-MACH-105525]

**Responsible:** Prof. Dr.-Ing. Xu Cheng
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189903 | Introduction to Nuclear Energy | 2 SWS | Lecture (V) | Cheng |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105525 | Introduction to Nuclear Energy | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-105525 | Introduction to Nuclear Energy | | Prüfung (PR) | Cheng |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none

# T 3.201 Course: Introduction to Numerical Fluid Dynamics [T-MACH-105515]

**Responsible:** Dr. Balazs Pritz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2157444 | Introduction to numerical fluid dynamics | 2 SWS | Practical course (P) | Pritz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105515 | Introduction to Numerical Fluid Dynamics | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105515 | Introduction to Numerical Fluid Dynamics | | Prüfung (PR) | Gabi |

**Competence Certificate**
Certificate of participation

**Prerequisites**
none

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

## V Introduction to numerical fluid dynamics

2157444, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
In the lab, the components of the cycle of computational fluid dynamics are worked through. In the first instance moderately complicated geometries will be generated and meshed. After the configuration and running the calculation, the results are presented and evaluated in a visualization software. While in the first part of the course these steps are worked out under guidance, calculation cycles are carried out independently in the second part. The test cases are discussed in detail and allow to strengthen the affinity to the fluid dynamics.

Content:

1. Brief introduction into Linux
2. Mesh generation with ICEMCFD
3. Data visualisation and interpretation with Tecplot
4. Handling of the flow solver SPARC
5. Self-designed calculation: flat plate
6. Introduction to unsteady calculations: flow around a circular cylinder

**Annotation**
In winter term 2012/2013:
Course: Computational Methods in Fluid Mechanics (Exercise) [2157442]

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

**Literature**
Lecture notes/handout

## T 3.202 Course: Introduction to numerical mechanics [T-MACH-108718]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108718 | Introduction to numerical mechanics | Prüfung (PR) | |

**Competence Certificate**
Oral Exam, 20 minutes

**Prerequisites**
None

**Annotation**
The lecture notes are made available via ILIAS.

## T 3.203 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162282 | Introduction to the Finite Element Method | 2 SWS | Lecture (V) | Langhoff, Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105320 | Introduction to the Finite Element Method | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105320 | Introduction to the Finite Element Method | | Prüfung (PR) | Böhlke, Langhoff |

### Competence Certificate
written exam (90 min). Addititves as announced

### Prerequisites
none

### Recommendation
The contents of the lectures "Advanced methods in strength of materials" and "Mathematical methods in strength of materials" are considered to be known.

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

## V Introduction to the Finite Element Method
2162282, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

### Learning Content

- introduction and motivation
- elements of tensor calculus
- the initial-boundary-value-problem of linear thermoconductivity
- the boundary-value-problem of linear elastostatic
- spatial discretization for 3D problems
- solution of the boundary-value-problem of elastostatic
- numerical solution of linear systems
- element types
- error estimation

### Workload
regular attendance: 42 hours
self-study: 108 hours

### Literature
lecture notes
Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007 (includes an introduction into ABAQUS)

## T 3.204 Course: Introduction to Theory of Materials [T-MACH-105321]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182732 | Introduction to Theory of Materials | 2 SWS | Lecture (V) | Kamlah |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105321 | Introduction to Theory of Materials | | Prüfung (PR) | Kamlah |
| WS 18/19 | 76-T-MACH-105321 | Introduction to Theory of Materials | | Prüfung (PR) | Gruber |

**Competence Certificate**
oral exam

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

### V Introduction to Theory of Materials
2182732, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

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

**Literature**
[1] Peter Haupt: Continuum Mechanics and Theory of Materials, Springer
[2] Lecture Notes

# T 3.205 Course: IoT platform for engineering [T-MACH-106743]

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

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123352 | IoT platform for engineering | SWS | Lecture (V) | Ovtcharova, Maier |
| WS 18/19 | 2123352 | IoT platform for engineering | SWS | Project/Seminar (PJ/S) | Ovtcharova, Maier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106743 | IoT platform for engineering | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76T-MACH-106743 | IoT platform for engineering | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Assessment of another type (graded), procedure see webpage. Number of participants limited to 20 people. There is a participant selection process.

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

## V IoT platform for engineering

2123352, WS 18/19, SWS, Open in study portal

**Project/Seminar (PJ/S)**

**Learning 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.

# T 3.206 Course: IT-Fundamentals of Logistics [T-MACH-105187]

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

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118183 | IT-Fundamentals of Logistics | 2 SWS | Lecture (V) | Thomas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105187 | IT-Fundamentals of Logistics | | Prüfung (PR) | Furmans, Mittwollen |
| WS 18/19 | 76-T-MACH-105187 | IT-Fundamentals of Logistics | | Prüfung (PR) | Furmans, Mittwollen |

**Competence Certificate**
The assessment consists of an oral exam (30min) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

**Annotation**
1) Detailed script can be downloaded online (www.tup.com), updated and enhanced annually.

2) CD-ROM with chapters and exercises at the end of the semester available from the lecturer, also updated and enhanced annually.

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

## V IT-Fundamentals of Logistics

2118183, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The rapid development of information technology influences business processes drastically.
A strategic IT-orientation for an enterprise without a critical appreciation of worldwide IT-development (where the half-life value of IT for logistic systems knowledge is less than 3 years) is dangerous. The pressure of costs is always in focus. For this purpose the contents of this course, as well as the detailed script will be continuously revised, and the influences on business processes will be shown in practical examples.

**Focuses:**

- **System architecture in Material Flow Control Systems (MFCS)**

A guiding principle for a new system architecture for MFC systems is the consideration of making new standardized, functional groups available for re-usability.

- **Design and application of innovative Material Flow Control Systems (MFCS)**

The most important task of the MFCS is the commissioning of conveying systems with driving commands in a way that optimally utilizes the facility and serves the logistics processes on schedule.

- **Identification of goods – Application in Logistics**

Along with business processes, coded information is the link between the flow of information and the flow of materials, and contributes to error prevention in the communication between people and machines.

- **Data communication in Intra-logistics**

Information describes the content of a message that is of value to the recipient.
The recipient can be both a human and a machine.

- **Business processes for Intra-logistics – Software follows function!**

If the business processes from Goods Incoming to Goods Outgoing are adapted with reusable building blocks then capabilities become visible. Against this background the consideration becomes apparent, how, through an innovative software architecture, a reusable building-block based framework can be made.
Therefore applies: Software follows function. And only if all project requirements are documented in the planing phase, and supported together in an inter-disciplinary team - consisting of logistics planners, the customers (users) and the implementation leader (IL).

- **Software development in accordance with industrial standards**

Today's development of object-oriented software, and the increasing penetration of industrial software production with this technology, makes it possible to create system designs that already offer these opportunities in their facility - both for a high degree of reuse and for easier adaptability.
In software development, object-oriented methods are used to improve the productivity, maintainability and software quality. An important aspect of object-orientation is: the objects used are primarily intended to depict the real world.

**Annotation**
1) Detailed script can be downloaded online (www.tup.com), updated and enhanced annually.
2) CD-ROM with chapters and exercises at the end of the semester available from the lecturer, also updated and enhanced annually.

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

# T 3.207 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-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2137306 | Lab Computer-aided methods for measurement and control | 3 SWS | Practical course (P) | Stiller, Richter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105341 | Lab Computer-Aided Methods for Measurement and Control | | Prüfung (PR) | Stiller |

**Competence Certificate**
Colloquia

**Prerequisites**
none

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

## V Lab Computer-aided methods for measurement and control

2137306, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
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.

**Workload**
120 hours

**Literature**
Instructions to the experiments are available on the institute's website

## T 3.208 Course: Lab Course Experimental Solid Mechanics [T-MACH-105343]

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

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162275 | Lab course experimental solid mechanics | 2 SWS | Practical course (P) | Lang, Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105343 | Lab Course Experimental Solid Mechanics | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105343 | Lab Course Experimental Solid Mechanics | | Prüfung (PR) | Böhlke |

**Competence Certificate**
**passed / not passed**
Each participant has to hand in six lab course report (eon for each day of lab course), which will be evaluated. At the end of the lab course, the participants have to give a colloquium (approx 20 min) about a given topic of the experiments done.

**Prerequisites**
none

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

### V Lab course experimental solid mechanics

2162275, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**

- Anisotropic materials
- Experiments for determination of the five material constants of thermoelasticity
- Experiments for determination of parameters of the inelatic material behaviour

**Workload**
regular attendance: 21,5 hours
self-study: 98,5 hours

**Literature**
is announced during lab course

# T 3.209 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Ulrich Maas
Heiner Wirbser

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2171487 | Laboratory Exercise in Energy Technology | 3 SWS | Practical course (P) | Bauer, Wirbser, Maas |
| WS 18/19 | 2171487 | Laboratory Exercise in Energy Technology | 3 SWS | Practical course (P) | Wirbser, Bauer, Maas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105331 | Laboratory Exercise in Energy Technology | | Prüfung (PR) | Bauer, Maas, Wirbser |
| WS 18/19 | 76-T-MACH-105331 | Laboratory Exercise in Energy Technology | | Prüfung (PR) | Bauer, Maas, Wirbser |

**Competence Certificate**
1 report, approx. 12 pages

Discussion of the documented results with the assistents

**Prerequisites**
none

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

## V Laboratory Exercise in Energy Technology

2171487, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

**Learning Content**

- 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

**Annotation**
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

**Workload**
regular attendance: 42h
self-study: 78h

V **Laboratory Exercise in Energy Technology** **Practical course (P)**
2171487, WS 18/19, 3 SWS, Open in study portal

**Learning Content**

- 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

**Annotation**
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

**Workload**
regular attendance: 42h
self-study: 78h

# T 3.210 Course: Laboratory Laser Materials Processing [T-MACH-102154]

**Responsible:** Dr.-Ing. Johannes Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2183640 | Laboratory "Laser Materials Processing" | 3 SWS | Practical course (P) | Schneider, Pfleging |
| WS 18/19 | 2183640 | Laboratory "Laser Materials Processing" | 3 SWS | Practical course (P) | Schneider, Pfleging |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102154 | Laboratory Laser Materials Processing | | Prüfung (PR) | Schneider |
| WS 18/19 | 76-T-MACH-102154 | Laboratory Laser Materials Processing | | Prüfung (PR) | Schneider |

### Competence Certificate
The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

### Prerequisites
none

### Recommendation
basic knowledge of physics, chemistry and material science

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

### Annotation
The maximum number of students is 12 per semester.

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

## V Laboratory "Laser Materials Processing"

2183640, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

### Description
**Media:**

lecture notes via ILIAS

### Learning 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.

**Annotation**
The maximum number of students is 12 per semester.

**Workload**
regular attendance: 34 hours
self-study: 86 hours

**Literature**
W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press

W.M. Steen: Laser Materials Processing, 2010, Springer

**V** | **Laboratory "Laser Materials Processing"**
2183640, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Description**
**Media:**

lecture notes via ILIAS

**Learning 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.

**Annotation**
The maximum number of students is 12 per semester.

**Workload**
regular attendance: 34 hours
self-study: 86 hours

**Literature**
W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press

W.M. Steen: Laser Materials Processing, 2010, Springer

# T 3.211 Course: Laboratory Mechatronics [T-MACH-105370]

**Responsible:** Dr.-Ing. Maik Lorch
Prof. Dr.-Ing. Wolfgang Seemann
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 3 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105014 | Laboratory mechatronics | 3 SWS | Practical course (P) | Seemann, Stiller, Lorch, Burgert |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105370 | Laboratory Mechatronics | | Prüfung (PR) | Stiller, Seemann |
| WS 18/19 | 76-T-MACH-105370 | Laboratory Mechatronics | | Prüfung (PR) | Stiller, Seemann |

**Competence Certificate**
certificate of successful attendance

**Prerequisites**
None

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

## V Laboratory mechatronics

2105014, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Learning 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

**Workload**
regular attendance: 33.5 h

self-study: 88.5 h

**Literature**
Manuals for the laboratory course on Mechatronics

## T 3.212 Course: Laboratory Production Metrology [T-MACH-108878]

**Responsible:** Dr.-Ing. Benjamin Häfner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150550 | Laboratory Production Metrology | 3 SWS | Practical course (P) | Häfner |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108878 | Laboratory Production Metrology | | Prüfung (PR) | Häfner |

**Competence Certificate**
Alternative test achievement:
Group presentation

**Prerequisites**
none

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

### V Laboratory Production Metrology
2150550, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

**Description**
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/). Additional reference to literature will be provided, as well.

**Notes**
Place, dates and deadlines for the lecture will be published on the homepage http://www.wbk.kit.edu/studium-und-lehre.php.

**Learning Content**
During this course, students get to know measurement systems that are used in a production system. In the age of Industry 4.0, sensors are becoming more important. Therefore, the application of in-line measurement technology such as machine vision and non-destructive testing is focussed. Additionally, laboratory based measurement technologies such as computed tomography are addressed. The student learn the theoretical background as well as practical applications for industrial examples. The students use sensors by themselves during the course. Additionally, they are trained on how to integrate sensors in production processes and how to analyze measurement data with suitable software. The following topics are addressed:

- Classification and examples for different measurement technologies in a production environment
- Machine vision with optical sensors
- Information fusion based on optical measurements
- Robot-based optical measurements
- Non-destructive testing by means of acoustic measurements
- Coodinate measurement technology
- Industrial computed tomography
- Measurement uncertainty evaluation
- Analysis of production data by means of data mining

**Workload**
regular attendance: 31,5 hours
self-study: 88,5 hours

# T 3.213 Course: Laser in Automotive Engineering [T-MACH-105164]

**Responsible:** Dr.-Ing. Johannes Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182642 | Laser in automotive engineering | 2 SWS | Lecture (V) | Schneider |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105164 | Laser in Automotive Engineering | | Prüfung (PR) | Schneider |
| WS 18/19 | 76-T-MACH-105164 | Laser in Automotive Engineering | | Prüfung (PR) | Schneider |

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

no tools or reference materials

**Prerequisites**
It is not possible, to combine this brick with brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102]

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
2. The course T-MACH-109084 - Physical Basics of Laser Technology must not have been started.

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

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

## V Laser in automotive engineering

2182642, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

lecture notes via ILIAS

**Learning Content**
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in automotive engineering
- economical aspects
- savety aspects

**Annotation**
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.

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

**Literature**
W. M. Steen: Laser Material Processing, 2010, Springer

W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

# T 3.214 Course: Leadership and Conflict Management [T-MACH-105440]

**Responsible:** Hans Hatzl
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110017 | Leadership and Conflict Management (in German) | 2 SWS | Lecture (V) | Hatzl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105440 | Leadership and Conflict Management | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105440 | Leadership and Conflict Management | | Prüfung (PR) | Deml |

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

**Prerequisites**
none

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

## V Leadership and Conflict Management (in German) — Lecture (V)
2110017, SS 2018, 2 SWS, Open in study portal

**Learning Content**

1. Introduction to the course
2. Goal definition and goal achievement
3. Management techniques within planning
4. Communication and information
5. Decision-making
6. Leadership and co-operation
7. Self management
8. Conflict management
9. Case studies

**Workload**
The amount of work accounts for 120 h (=4 ECTS).

**Literature**
Handout and literature are available on ILIAS for download.

# T 3.215 Course: Leadership and Management Development [T-MACH-105231]

**Responsible:** Dipl. -Psych. Dipl. -Kfm. Andreas Ploch
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2145184 | Leadership and Product Development | 2 SWS | Lecture (V) | Ploch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105231 | Leadership and Management Development | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105231 | Leadership and Management Development | | Prüfung (PR) | Albers |

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

**Prerequisites**
none

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

## V Leadership and Product Development
2145184, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Leadership theories

Management tools

Communication as management tool

Change management

Management development and MD-Programs

Assessment center and management audits

Team work, team development und team roles

Intercultural competences

Leadership and ethics, Corporate Governance

Executive Coaching

Lectures of industrial experts

**Workload**
regular attendance: 21 h

self-study: 99 h

# T 3.216 Course: Learning Factory “Global Production“ [T-MACH-105783]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149612 | Lernfabrik Globale Produktion | 2 SWS | Seminar / Practical course (S/P) | Lanza |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105783 | Lernfabrik Globale Produktion | | Prüfung (PR) | Lanza |
| WS 18/19 | 76-T-MACH-105783 | Learning Factory "Global Production" | | Prüfung (PR) | Lanza |

**Competence Certificate**
Alternative test achievement (graded):

- Knowledge acquisition in the context of the seminar (3 achievements 20 min each ) with weighting 40%.
- Interaction between participants with weighting 15%.
- Scientific colloquium (in groups of 3 students approx. 45 min each) with weighting 45%.

**Prerequisites**
Successful completion of one of the following courses:

- Integrated Production Planning in the Age of Industry 4.0 [T-MACH-108849 or T-MACH-109054]
- Integrated Production Planning [T-MACH-102106]
- Global Production and Logistics – Part 1: Global Production [T-MACH-105158]
- Quality Management [T-MACH-102107]

**Modeled Conditions**
You have to fulfill one of 5 conditions:

1. The course T-MACH-102106 - Integrated Production Planning must have been passed.
2. The course T-MACH-105158 - Global Production and Logistics - Part 1: Global Production must have been passed.
3. The course T-MACH-102107 - Quality Management must have been passed.
4. The course T-MACH-108849 - Integrated Production Planning in the Age of Industry 4.0 must have been passed.
5. The course T-MACH-109054 - Integrated Production Planning in the Age of Industry 4.0 must have been passed.

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

## V Lernfabrik Globale Produktion

**Seminar / Practical course (S/P)**

2149612, WS 18/19, 2 SWS, Open in study portal

**Description**
**Media:**
e-learning platform ilias, powerpoint, photo protocol. The media are provided through ilias (https://ilias.studium.kit.edu/).

**Notes**
For organizational reasons the number of participants for the course is limited to 20. Hence a selection process will take place. Applications are made via the homepage of wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

**Learning Content**

The learning factory “Global Production“ serves as a modern teaching environment for the challenges of global production. To make this challenges come alive, students can run a production of electric motors under real production conditions.

The course is divided into e-learning units and presence dates. The e-learning units help to learn essential basics and to immerse themselves in specific topics (e.g. selection of location, supplier selection and planning of production networks). The focus of the

presence appointments is the case-specific application of relevant methods for planning and control of production systems that are suitable for the location. In addition to traditional methods and tools to organize lean production systems (e.g. Kanban and JIT/ JIS,

Line Balancing) the lecture in particular deals with site-specific quality assurance and scalable automation. Essential methods for quality assurance in complex production systems are taught and brought to practical experience by a Six Sigma project. In the area of scalable automation, it is important to find solutions for the adaption of the level of automation of the production system to the local production conditions (e.g. automated workpiece transport, integration of lightweight robots for process linking) and to

implement them physically. At the same time safety concepts should be developed and implemented as enablers for human-robot collaboration.

The course also includes an excursion to the production plant for the manufacturing of electric motors of an industrial partner.

Main focus of the lecture:

- site selection
- site-specific factory planning
- site-specific quality assurance
- scalable automation
- supplier selection

**Workload**

e-Learning: ~ 24 h
regular attendence: ~ 36 h
self-study: ~ 60 h

## T 3.217 Course: Lightweight Engineering Design [T-MACH-105221]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146190 | Lightweight Engineering Design | 2 SWS | Lecture (V) | Albers, Burkardt |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105221 | Lightweight Engineering Design | | Prüfung (PR) | Albers, Burkardt |
| WS 18/19 | 76-T-MACH-105221 | Lightweight Engineering Design | | Prüfung (PR) | Albers |

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

**Prerequisites**
None

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

### V Lightweight Engineering Design

2146190, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Beamer

**Learning Content**
General aspects of leightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling

Additionally, guest speakers from industry will present lightweight design from an practical point of view.

**Annotation**
Lecture slides are available via eLearning-Platform ILIAS.

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**

Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007

Wiedemann, J.: Leichtbau: Elemente und Konstruktion, Springer Verlag, 2006

Harzheim, L.: Strukturoptimierung. Grundlagen und Anwendungen. Verlag Harri Deutsch, 2008

## T 3.218 Course: Localization of Mobile Agents [T-INFO-101377]

**Responsible:** Prof. Dr.-Ing. Uwe Hanebeck
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24613 | Localization of Mobile Agents | 3 SWS | Lecture (V) | Noack, Rosenthal |
| **Exams** | | | | | |
| SS 2018 | 7500004 | Localization of Mobile Agents | | Prüfung (PR) | Hanebeck, Noack |
| WS 18/19 | 7500020 | Localization of Mobile Agents | | Prüfung (PR) | Noack, Hanebeck |

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

### V Localization of Mobile Agents
24613, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
The amount of work required is ca.180 hours.

# T 3.219 Course: Logistics - Organisation, Design and Control of Logistic Systems [T-MACH-102089]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118078 | Logistics - Organisation, Design, and Control of Logistic Systems | 3 SWS | Lecture (V) | Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102089 | Logistics - Organisation, Design and Control of Logistic Systems | | Prüfung (PR) | Furmans, Mittwollen |
| WS 18/19 | 76-T-MACH-102089 | Logistics - Organisation, Design and Control of Logistic Systems | | Prüfung (PR) | Furmans, Mittwollen |

**Competence Certificate**
The assessment consists of a 90 minutes written examination (according to §4(2), 1 of the examination regulation).

**Prerequisites**
None

**Recommendation**
Requied are lectures on “Linear Algebra” and “Stochastic”.

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

## V Logistics - Organisation, Design, and Control of Logistic Systems

2118078, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Blackboard, LCD projector, in excercises also PCs.

**Learning Content**
Introduction

- historical overview
- lines of development

Structure of logistics systems

Distribution logistics

- location planning
- Vehicle Routing Planning
- distribution centers

Inventory management

- demand forecasting
- Inventory management policies
- Bullwhip effect

Production logistics

- layout planning
- material handling
- flow control

Supply Managament

- information flow
- transportation organization
- controlling and development of a logistics system
- co-operation mechanisms
- Lean SCM
- SCOR model

Identification Technologies

**Workload**
180 hrs

**Literature**

- Arnold/Isermann/Kuhn/Tempelmeier. Handbuch Logistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren, Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, Oldenbourg Verlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research, Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in Supply Chains, Books on Demand 2006
- Schönsleben. Integrales Logistikmanagement, Springer, 1998

## T 3.220 Course: Machine Dynamics [T-MACH-105210]

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

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2161224 | Machine Dynamics | 2 SWS | Lecture (V) | Proppe |
| SS 2018 | 2161225 | Machine Dynamics (Tutorial) | 1 SWS | Practice (Ü) | Proppe, Koebele |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105210 | Machine Dynamics | | Prüfung (PR) | Proppe |
| WS 18/19 | 76-T-MACH-105210 | Machine Dynamics | | Prüfung (PR) | Proppe |

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

**Prerequisites**
none

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

### V Machine Dynamics
2161224, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
Lectures and exercices: 32 h

Studies: 118 h

**Literature**
Biezeno, Grammel: Technische Dynamik, 2. Edition, 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

V

**Machine Dynamics (Tutorial)**

2161225, SS 2018, 1 SWS, Open in study portal

**Practice (Ü)**

**Learning Content**

Excercises related to the lecture

## T 3.221 Course: Machine Dynamics II [T-MACH-105224]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2162220 | Machine Dynamics II | 2 SWS | Lecture (V) | Proppe |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105224 | Machine Dynamics II | | Prüfung (PR) | Proppe |
| WS 18/19 | 76-T-MACH-105224 | Machine Dynamics II | | Prüfung (PR) | Proppe |

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

**Prerequisites**
none

**Recommendation**
Machine Dynamics

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

### V Machine Dynamics II

2162220, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
• hydrodynamic bearings

• rotating shafts in hydrodynamic bearings

• belt drives

• virbation of turbine blades

**Workload**
Lectures: 20 h

Self-studies: 100 h

**Literature**
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

# T 3.222 Course: Machine Tools and Industrial Handling [T-MACH-109055]

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

**Part of:** M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149902 | Machine Tools and Industrial Handling | 6 SWS | Lecture / Practice (VÜ) | Fleischer |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-109055 | Machine Tools and Industrial Handling | | Prüfung (PR) | Fleischer |

**Competence Certificate**
Oral exam (40 minutes)

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

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

## V Machine Tools and Industrial Handling

2149902, WS 18/19, 6 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

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

**Notes**
Lectures on Mondays and Wednesdays, tutorial on Thursdays.
The tutorial dates will announced in the first lecture.

**Learning Content**
The lecture gives an overview of the construction, use and application of machine tools and industrial handling equipment. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools is conveyed. First, the main components of the machine tools are systematically explained and their design principles as well as the integral machine tool design are discussed. Subsequently, the use and application of machine tools will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0.

The individual topics are:

- Frames and frame components
- Feed axes
- Spindles
- Peripheral equipment
- Control unit
- Metrological evaluation and machine testing
- Process monitoring
- Maintenance of machine tools
- Safety assessment of machine tools
- Machine examples

**Annotation**
None

**Workload**
MACH:
regular attendance: 63 hours
self-study: 177 hours
WiIng:/TVWL
regular attendance: 63 hours
self-study: 207 hours

# T 3.223 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-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 8 | Each winter term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2137308 | Machine Vision | 4 SWS | Lecture / Practice (VÜ) | Lauer, Quehl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105223 | Machine Vision | | Prüfung (PR) | Stiller, Lauer |
| WS 18/19 | 76-T-MACH-105223 | Machine Vision | | Prüfung (PR) | Stiller, Lauer |

**Competence Certificate**
Type of Examination: written exam

Duration of Examination: 60 minutes

**Prerequisites**
None

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

## V Machine Vision

2137308, WS 18/19, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
The lecture on machine vision covers basic techniques of machine vision. It focuses on the following topics:

image preprocessing

edge and corner detection

curve and parameter fitting

color processing

image segmentation

camera optics

pattern recognition

deep learning

Image preprocessing:

The chapter on image processing discusses techniques and algorithms to filter and enhance the image quality. Starting from an analysis of the typical phenomena of digital camera based image capturing the lecture introduces the Fourier transform and the Shannon-Nyquist sampling theorem. Furthermore, it introduces gray level histogram based techniques including high dynamic range imaging. The disussion of image convolution and typical filters for image enhancement concludes the chapter.

Edge and corner detection:

Gray level edges and gray level corners play an important role in machine vision since gray level edges often reveal valueable information about the boundaries and shape of objects. Gray level corners can be used as feature points since they can be identified easily in other images. This chapter introduces filters and algorithms to reveal gray level edges and gray level corners like the Canny edge detector and the Harris corner detector.

Curve and parameter fitting:

In order to describe an image by means of geometric primitives (e.g. lines, circles, ellipses) instead of just pixels robust curve and parameter fitting algorithms are necessary. The lecture introduces and discusses the Hough transform, total least sum of squares parameter fitting as well as robust alternatives (M-estimators, least trimmed sum of squares, RANSAC)

Color processing:

The short chapter on color processing discusses the role of color information in machine vision and introduces various models for color understanding and color representation. It concludes with the topic of color consistency.

Image Segmentation:

Image segmentation belongs to the core techniques of machine vision. The goal of image segmentation is to subdivide the image into several areas. Each area shares common properties, i.e. similar color, similar hatching, or similar semantic interpretation. Various ideas for image segmentation exist which can be used to create more or less complex algorithms. The lecture introduces the most important approaches ranging from the simpler algorithms like region growing, connected components labeling, and morphological operations up to highly flexible and powerful methods like level set approaches and random fields.

Camera optics:

The content of an image is related by the optics of the camera to the 3-dimensional world. In this chapter the lecture introduces optical models that describe the relationship between the world and the image including the pinhole camera model, the thin lens model, telecentric cameras, and catadioptric sensors. Furthermore, the lecture introduces camera calibration methods that can be used to determine the optical mapping of a real camera.

Pattern recognition:

Pattern recognition aims at recognizing semantic information in an image, i.e. not just analyzing gray values or colors of pixels but revealing which kind of object is shown by the pixels. This task goes beyond classical measurement theory and enters the large field of artificial intelligence. Rather than just being developped and optimized by a programmer, the algorithms are adapting themselves to their specific task using training algorithms that are based on large collections of sample images.

The chapter of pattern recognition introduces standard techniques of pattern recognition in the context of image understanding like the support vector machine (SVM), decision trees, ensemble and boosting techniques. It combines those classifiers with powerful feature representation techniques like the histogram of oriented gradients (HOG) features, locally binary patterns (LBP), and Haar features.

Deep learning:

Throughout recent years standard pattern recognition technqiues have more and more been outperformed by deep learning techniques. Deep learning is based on artificial neural networks, a very generic and powerful form of a classifier. The lecture introduces multi layer perceptrons as the most relevant form of artificial neural networks, discusses training algorithms and strategies to achieve powerful classifiers based on deep learning including deep auto encoders, convolutional networks, and multi task learning, among others.

**Workload**
240 hours

**Literature**
Main results are summarized in the slides that are made available as pdf-files. Further recommendations will be presented in the lecture.

# T 3.224 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190496 | Magnet Technology of Fusion Reactors | 2 SWS | Lecture (V) | Fietz, Weiss |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105434 | Magnet Technology of Fusion Reactors | | Prüfung (PR) | Cheng |
| WS 18/19 | 76-T-MACH-105434 | Magnet Technology of Fusion Reactors | | Prüfung (PR) | Cheng |

**Competence Certificate**
Oral examination of about 30 minutes

**Prerequisites**
none

**Annotation**
none

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

## V Magnet Technology of Fusion Reactors

2190496, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
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:**

- Introduction to plasma, fusion and electromagnets
- Introduction superconductivity - basics and materials
- Creation of low temperatures, cryo-technique
- Material properties at low temperature
- Magnet design and calculation
- Magnet stability, quench safety and high voltage protection
- Magnet examples
- High-temperature superconductors (HTS)
- HTS-application (cable, motor/generator, FCL, current leads, fusion reactors)

**Workload**
- 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

# T 3.225 Course: Magnetohydrodynamics [T-MACH-108845]

**Responsible:** Prof. Dr. Leo Bühler
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153429 | Magnetohydrodynamics | 2 SWS | Lecture (V) | Bühler |

**Competence Certificate**
The study performance is considered to have been passed if all exercise assignments have been successfully processed and the final colloquium (30 minutes) has been successfully passed.

No auxiliary mean

**Prerequisites**
The partial performance number T-MACH-105426 "Magnetohydrodynamics" must not be startet or completed.

The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105426 - Magnetohydrodynamics must not have been started.

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

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

## V Magnetohydrodynamics

2153429, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

**Annotation**
Recommendation: Fluid Mechanics

**Workload**
regular attendance: 21 hours

self-study: 90 hours

**Literature**

U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

## T 3.226 Course: Magnetohydrodynamics [T-MACH-105426]

**Responsible:** Prof. Dr. Leo Bühler
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153429 | Magnetohydrodynamics | 2 SWS | Lecture (V) | Bühler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105426 | Magnetohydrodynamics | | Prüfung (PR) | Bühler |
| WS 18/19 | 76-T-MACH-105426 | Magnetohydrodynamics | | Prüfung (PR) | Bühler |

**Competence Certificate**
oral

Duration: 30 minutes

No auxiliary means

**Prerequisites**
The partial performance number T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) must not be startet or completed.

The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-108845 - Magnetohydrodynamics must not have been started.

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

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

### V Magnetohydrodynamics
2153429, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

**Annotation**
Recommendation: Fluid Mechanics

**Workload**
regular attendance: 21 hours

self-study: 90 hours

**Literature**

U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

## T 3.227 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-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 8 | Each winter term | 3 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149657 | Manufacturing Technology | 6 SWS | Lecture / Practice (VÜ) | Schulze, Zanger |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102105 | Manufacturing Technology | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-102105 | Manufacturing Technology | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-102105-Mündl. | Manufacturing Technology | | Prüfung (PR) | Schulze |

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

**Prerequisites**
none

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

## V Manufacturing Technology

2149657, WS 18/19, 6 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

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

**Learning Content**
The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different
manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and
deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.
The following topics will be covered:

- Quality control
- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming, plastics engineering)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment
- Process chains in manufacturing

This lucture provides an excursion to an industry company.

**Annotation**
None

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

**Literature**
Lecture Notes

## T 3.228 Course: Master's Thesis [T-MACH-105299]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier
**Organisation:** KIT Department of Mechanical Engineering
**Part of:** M-MACH-102858 - Masterarbeit

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Abschlussarbeit | 30 | Each term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| SS 2018 | 76-T-MACH-105299 | Master Thesis | Prüfung (PR) | |
| WS 18/19 | 76-T-MACH-105299 | Master Thesis | Prüfung (PR) | |

**Competence Certificate**
The master thesis is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.
The maximal processing time of the master thesis takes three months. With consent of the examiner the thesis can be written in another language than German as well. The date of issue of the subject has to be fixed by the supervisor and the student and to be put on record at the examination board. The subject of the master thesis may be only returned once and only within the first month of processing time.
On a reasoned request of the student, the examination board can extend the processing time by up to one month. If the master thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.
The master thesis is to be evaluated by not less than a professor or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITG and another examiner. Generally, one of the two examiners is the person who has assigned the thesis. If the examiners do not agree, the master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master thesis has to be graded within a period of six weeks after the submission.

**Prerequisites**
The requirement for admission to the master thesis module are 74 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

**Modeled Conditions**
The following conditions have to be fulfilled:

1. You need to earn at least 74 credits in the following fields:
    - Advanced Engineering Fundamentals
    - Specialization

## T 3.229 Course: Material Flow in Logistic Systems [T-MACH-102151]

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

**Part of:** M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 6 | Each winter term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117051 | Material flow in logistic systems | 4 SWS | Others (sonst.) | Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102151 | Material Flow in Logistic Systems | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-102151 | Material Flow in Logistic Systems | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
    - 40% assessment of the result of the case studies as group work,
    - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

**Prerequisites**
none

**Recommendation**
Recommended elective subject: Probability Theory and Statistics

**Annotation**
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

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

### V Material flow in logistic systems

2117051, WS 18/19, 4 SWS, Open in study portal

**Others (sonst.)**

**Description**
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. 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).

**Media:** Presentations, black board, book, video recordings

**Learning Content**

- Elements of material flow systems (conveyor elements, fork, join elements)
- Models of material flow networks using graph theory and matrices
- Queueing theory, calculation of waiting time, utilization
- Warehouseing and order-picking
- Shuttle systems
- Sorting systems
- Simulation
- Calculation of availability and reliability
- Value stream analysis

**Annotation**
none

**Workload**
Regular attendance: 30 h

Self-study: 100 h

Group work: 50 h

**Literature**
**Arnold, Dieter; Furmans, Kai :** Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

## T 3.230 Course: Materials and Processes for Body Leightweight Construction in the Automotive Industry [T-MACH-105166]

**Responsible:** Dr. Stefan Kienzle
Dr. Dieter Steegmüller

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2149669 | Materials and Processes for Body Lightweight Construction in the Automotive Industry | 2 SWS | Lecture (V) | Steegmüller, Kienzle |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105166 | Materials and Processes for Body Leightweight Construction in the Automotive Industry | | Prüfung (PR) | Fleischer |
| WS 18/19 | 76-T-MACH-105166 | Materials and Processes for Body Leightweight Construction in the Automotive Industry | | Prüfung (PR) | Schulze |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
none

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

### V Materials and Processes for Body Lightweight Construction in the Automotive Industry

**Lecture (V)**

2149669, WS 18/19, 2 SWS, Open in study portal

**Description**
**Media:**

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

**Notes**
The lecture is a block course. An application in Ilias is mandatory.

**Learning Content**

The objective of the lecture is to build up an overview of the relevant materials and processes for the production of a lightweight body. This includes both the actual production and the joining for the body. The lecture covers the different lightweight approaches and possible fields of application in the automotive industry. The methods are discussed with practical examples from the automotive industry.

The following topics will be covered:

- lightweight designs
- aluminium and steel for lightweight construction
- fiber-reinforced plastics by the RTM and SMC process
- joining of steel and aluminium (clinching, riveting, welding)
- bonding
- coating
- finishing
- quality assurance
- virtual factory

**Workload**

regular attendance: 21 hours
self-study: 99 hours

## T 3.231 Course: Materials Characterization [T-MACH-107684]

**Responsible:** Dr.-Ing. Jens Gibmeier
**Organisation:** KIT Department of Mechanical Engineering
**Part of:** M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2174586 | Werkstoffanalytik | 2 SWS | Lecture (V) | Schneider, Gibmeier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107684 | Materials Characterization | | Prüfung (PR) | Heilmaier, Gibmeier |
| WS 18/19 | 76-T-MACH-107684 | Materials Characterization | | Prüfung (PR) | Heilmaier, Gibmeier |

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

**Prerequisites**
T-MACH-107685 - Exercises for Materials Characterization must be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must have been passed.

## T 3.232 Course: Materials Modelling: Dislocation Based Plasticy [T-MACH-105369]

**Responsible:** Dr. Daniel Weygand
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182740 | Materials modelling: dislocation based plasticy | 2 SWS | Lecture (V) | Weygand, Gagel |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105369 | Materials Modelling: Dislocation Based Plasticy | | Prüfung (PR) | Weygand |
| WS 18/19 | 76-T-MACH-105369 | Materials Modelling: Dislocation Based Plasticity | | Prüfung (PR) | Weygand |

**Competence Certificate**
oral exam

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

## V Materials modelling: dislocation based plasticy

2182740, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

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

**Literature**

1. D. Hull and D.J. Bacon, Introduction to Dislocations, Oxford Pergamon 1994
2. W. Cai and W. Nix, Imperfections in Crystalline Solids, Cambridge University Press, 2016
3. J.P. Hirth and J. Lothe: Theory of dislocations, New York Wiley 1982. (oder 1968)
4. J. Friedel, Dislocations, Pergamon Oxford 1964.
5. V. Bulatov, W. Cai, Computer Simulations of Dislocations, Oxford University Press 2006
6. A.S. Argon, Strengthening mechanisms in crystal plasticity, Oxford materials.

# T 3.233 Course: Materials of Lightweight Construction [T-MACH-105211]

**Responsible:** Prof. Dr.-Ing. Kay Weidenmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174574 | Materials for Lightweight Construction | 2 SWS | Lecture (V) | Weidenmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105211 | Materials of Lightweight Construction | | Prüfung (PR) | Weidenmann |
| WS 18/19 | 76-T-MACH-105211 | Materials of Lightweight Construction | | Prüfung (PR) | Weidenmann |

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

**Prerequisites**
none

**Recommendation**
Materials Science I/II

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

## V Materials for Lightweight Construction

**Lecture (V)**

2174574, SS 2018, 2 SWS, Open in study portal

**Learning 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

**Workload**
The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

**Literature**
Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given

## T 3.234 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-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173553 | Materials Science and Engineering III | 4 SWS | Lecture (V) | Heilmaier, Lang |
| WS 18/19 | 2173554 | Übungen zu Werkstoffkunde III | 1 SWS | Practice (Ü) | Heilmaier, Kauffmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105301 | Materials Science III | | Prüfung (PR) | Heilmaier, Lang |
| WS 18/19 | 76-T-MACH-105301 | Materials Science III | | Prüfung (PR) | Heilmaier, Lang |

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

**Prerequisites**
none

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

### V Materials Science and Engineering III
2173553, WS 18/19, 4 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
regular attendance: 53 hours
self-study: 187 hours

**Literature**
Lecture Notes; Problem Sheets; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

## T 3.235 Course: Mathematical Fundamentals of Numerical Mechanics [T-MACH-108957]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108957 | Mathematical Fundamentals of Numerical Mechanics | Prüfung (PR) | |

**Competence Certificate**
Oral Examination Duration: 20 minutes

**Prerequisites**
None

**Recommendation**
none

## T 3.236 Course: Mathematical Methods in Dynamics [T-MACH-105293]

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

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161206 | Mathematical Methods in Dynamics | 2 SWS | Lecture (V) | Proppe |
| WS 18/19 | 2161207 | Übungen zu Mathematische Methoden der Dynamik | 1 SWS | Practice (Ü) | Koebele, Proppe |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105293 | Mathematical Methods in Dynamics | | Prüfung (PR) | Proppe |
| WS 18/19 | 76-T-MACH-105293 | Mathematical Methods in Dynamics | | Prüfung (PR) | Proppe |

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

**Prerequisites**
none

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

### V Mathematical Methods in Dynamics
2161206, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

**Workload**
Lectures and exercices: 32 h

Studies: 118 h

**Literature**
Lecture notes (available online)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

V **Übungen zu Mathematische Methoden der Dynamik** **Practice (Ü)**
2161207, WS 18/19, 1 SWS, Open in study portal

**Learning Content**
Excercises related to the lecture

# T 3.237 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102594 - Mathematische Methoden
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154432 | Mathematical Methods in Fluid Mechanics | 2 SWS | Lecture (V) | Frohnapfel, Gatti |
| SS 2018 | 2154433 | Tutorial in Mathematical Methods of Fluid Mechanics | 1 SWS | Practice (Ü) | Frohnapfel, Gatti |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105295 | Mathematical Methods in Fluid Mechanics | | Prüfung (PR) | Frohnapfel, Gatti |
| WS 18/19 | 7600001 | Mathematical Methods in Fluid Mechanics | | Prüfung (PR) | Frohnapfel, Gatti |
| WS 18/19 | 76-T-MACH-105295 | Mathematical Methods in Fluid Mechanics | | Prüfung (PR) | |

**Competence Certificate**
written examination - 3 hours

**Prerequisites**
none

**Recommendation**
Basic Knowledge about Fluid Mechanics

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

## V Mathematical Methods in Fluid Mechanics

2154432, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

chalk board, Power Point

**Learning Content**
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)

**Workload**
regular attendance: 30 hours
self-study: 150 hours

**Literature**

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

## V Tutorial in Mathematical Methods of Fluid Mechanics

2154433, SS 2018, 1 SWS, Open in study portal

**Practice (Ü)**

**Description**

**Media:**

chalk board, Power Point

**Learning 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)

**Workload**

regular attendance: 10,5 hours
self-study: 49,5 hours

**Literature**

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge

Mathematical Library, 2000

Boiko, A. V., Grek, G. R., Dovgal, A. V., Kozlov, V. V.: The Origin of Turbulence in Near-Wall Flows, Springer, 2002

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

# T 3.238 Course: Mathematical Methods in Strength of Materials [T-MACH-100297]

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

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each winter term | 4 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161254 | Mathematical Methods in Strength of Materials | 2 SWS | Lecture (V) | Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100297 | Mathematical Methods in Strength of Materials | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-100297 | Mathematical Methods in Strength of Materials | | Prüfung (PR) | Böhlke |

**Competence Certificate**
written exam (90 min). Additives as announced.

**Prerequisites**
Passing the Tutorial to Mathematical Methods of Strength of Materials

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-106830 - Tutorial Mathematical Methods in Strength of Materials must have been passed.

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

## V Mathematical Methods in Strength of Materials

2161254, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Tensor algebra

- vectors; basis transformation; dyadic product; tensors of 2nd order
- properties of 2nd order tensors: symmetry, anti-symmetry, orthogonality etc.
- eigenvalue problem, theorem of Cayley-Hamilton, invariants; tensors of higher order
- tensor algebra in curvilinear coordinate systems
- tensor analysis in curvilinear coordinate systems
- Differentiation of tensor functions

Application of tensor calculus in strength of materials

- kinematics of infinitesimal and finite deformations
- transport theorem, balance equations, stress tensor
- theory of elasticity
- thermo-elasticity

**Workload**
regular attendance: 31,5 hours
self-study: 118,5 hours

**Literature**
lecture notes
Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer, 2001.

# T 3.239 Course: Mathematical Methods in Structural Mechanics [T-MACH-105298]

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

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162204 | Sprechstunde zu Mathematische Methoden der Strukturmechanik | 2 SWS | Consultation-hour (Sprechst.) | Kehrer |
| SS 2018 | 2162280 | Mathematical Methods in Structural Mechanics | 2 SWS | Lecture (V) | Böhlke, Langhoff |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105298 | Mathematical Methods in Structural Mechanics | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105298 | Mathematical Methods in Structural Mechanics | | Prüfung (PR) | Böhlke |

**Competence Certificate**
written exam; if necessary oral exam.

Additives as announced.

**Prerequisites**
Prerequisites are met by solving exercises.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-106831 - Tutorial Mathematical Methods in Structural Mechanics must have been passed.

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

## V Mathematical Methods in Structural Mechanics

2162280, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Basics of variational calculus

- functionals; Frechet-differential; Gateaux-differential; maximum or minimum problems
- lemma of variational calculus and Lagrange delta-process; Euler-Lagrange-equations

Applications: Principals of continuums mechanics

- variational principals in mechanics; variational formulierung of boundary value problem of elastostatic

Applications: Homogenization methods for materials with microstructure

- mesoscopic and macroskopic stress and strain measures
- Mean values of ensembles, ergodicity
- effective elastic properties
- Homogenization of thermo-elastic properties
- Homogenization of plastic and visco-plastic properties
- Fe-based homogenization

**Workload**
regular attendance: 31,5 hours
self-study: 118,5 hours

**Literature**
Vorlesungsskript
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994.
Gross, D., Seelig, T.: Bruchmechanik – Mit einer Einführung in die Mikromechanik.
Springer 2002.
Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977
Torquato, S.: Random Heterogeneous Materials. Springer, 2002.

# T 3.240 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162241 | Mathematical methods of vibration theory | 2 SWS | Lecture (V) | Seemann |
| SS 2018 | 2162242 | Mathematical methods of vibration theory (Tutorial) | 2 SWS | Practice (Ü) | Seemann, Becker |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105294 | Mathematical Methods of Vibration Theory | | Prüfung (PR) | Seemann |
| WS 18/19 | 76-T-MACH-105294 | Mathematical Methods of Vibration Theory | | Prüfung (PR) | Seemann |

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

**Prerequisites**
none

**Recommendation**
Engineering Mechanics III/IV

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

## V Mathematical methods of vibration theory

2162241, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
time of attendance: 24h; self-study: 65h

**Literature**
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

## V Mathematical methods of vibration theory (Tutorial)

2162242, SS 2018, 2 SWS, Open in study portal

**Practice (Ü)**

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

**Workload**
time of attendance: 10,5h; self-study: 20h

**Literature**
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

## T 3.241 Course: Mathematical Models and Methods for Production Systems [T-MACH-105189]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
Marion Rimmele

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117059 | Mathematical models and methods for Production Systems | 4 SWS | Lecture (V) | Stoll, Rimmele, Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105189 | Mathematical models and methods for Production Systems | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105189 | Mathematical models and methods for Production Systems | | Prüfung (PR) | Furmans |

### Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

### Prerequisites
none

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

## V Mathematical models and methods for Production Systems
2117059, WS 18/19, 4 SWS, Open in study portal

**Lecture (V)**

### Description
**Media:**

black board, lecture notes, presentations

### Notes
lecture language: english

### Learning Content

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

**Workload**
regular attendance: 42 hours
self-study: 198 hours

**Literature**
Wolff: Stochastic Modeling and the Theory of Queues, Prentice Hall, 1989
Shanthikumar, Buzacott: Stochastic Models of Manufacturing Systems

# T 3.242 Course: Mathematical Models and Methods in Combustion Theory [T-MACH-105419]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2165525 | Mathematical models and methods in combustion theory | 2 SWS | Lecture (V) | Bykov |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105419 | Mathematical Models and Methods in Combustion Theory | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105419 | Mathematical Models and Methods in Combustion Theory | | Prüfung (PR) | Maas |

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

**Prerequisites**
none

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

## V Mathematical models and methods in combustion theory

2165525, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
Regular attendance: 22.5 h

Self-study: 97.5 h

**Literature**
Combustion Theory, F A Williams, (2nd Edition), 1985, Benjamin Cummins.

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, J. Warnatz, U. Mass and R. W. Dibble, (3nd Edition), Springer-Verlag, Heidelberg, 2003.

The Mathematical Theory of Combustion and Explosions, Ya.B. Zeldovich, G.I. Barenblatt, V.B. Librovich, G.M. Makhviladze, Springer, New York and London, 1985.

# T 3.243 Course: Measurement [T-ETIT-101937]

**Responsible:** Prof. Dr.-Ing. Fernando Puente León
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Version |
|---|---|---|
| Prüfungsleistung schriftlich | 5 | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2302105 | Messtechnik | 2 SWS | Lecture (V) | Puente León |
| WS 18/19 | 2302107 | Übungen zu 2302105 Messtechnik | 1 SWS | Practice (Ü) | Puente León, Schambach |
| **Exams** | | | | | |
| SS 2018 | 7302105 | Measurement Engineering | | Prüfung (PR) | Puente León |
| WS 18/19 | 7302105 | Measurement Engineering | | Prüfung (PR) | Puente León |

## T 3.244 Course: Measurement II [T-MACH-105335]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2138326 | Measurement II | 2 SWS | Lecture (V) | Stiller, Wirth |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105335 | Measurement II | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105335 | Measurement II | | Prüfung (PR) | Stiller |

**Competence Certificate**
written exam

60 min.

2 DIN A4 Self-created formular sheets allowed

**Prerequisites**
none

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

### V Measurement II
2138326, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

**Workload**
120 hours

**Literature**
Various Scripts

# T 3.245 Course: Measurement Instrumentation Lab [T-MACH-105300]

**Responsible:** Max Spindler
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2138328 | Measurement Instrumentation Lab | 2 SWS | Practical course (P) | Stiller, Richter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105300 | Measurement Instrumentation Lab | | Prüfung (PR) | Stiller |
| WS 18/19 | 76-T-MACH-105300 | Measurement Instrumentation Lab | | Prüfung (PR) | Stiller |

**Competence Certificate**
Non graded colloquia

**Prerequisites**
none

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

## V Measurement Instrumentation Lab

2138328, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Notes**
Please consider the bulletin on our website!

**Learning Content**
**A Signal recording**

- measurement of temperature
- measurement of lengths

**B Signal pre-precessing**

- bridge circuits and principles of measurement
- analog/digital transducers

**C Signal processing**

- measuring stochastic signals

**D Complete systems**

- system identification
- inverse pendulum
- mobile robot platform

**Workload**
90 hours

**Literature**
Instructions to the experiments are available on the institute's website

## T 3.246 Course: Mechanics and Strength of Polymers [T-MACH-105333]

**Responsible:** Prof. Dr.-Ing. Bernd-Steffen von Bernstorff
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102632 - Schwerpunkt: Polymerengineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173580 | Mechanics and Strengths of Polymers | 2 SWS | Lecture (V) | von Bernstorff |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105333 | Mechanics and Strengths of Polymers | | Prüfung (PR) | von Bernstorff |
| WS 18/19 | 76-T-MACH-105333 | Mechanics and Strengths of Polymers | | Prüfung (PR) | von Bernstorff |

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

**Prerequisites**
none

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

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

### V Mechanics and Strengths of Polymers

2173580, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**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**
A literature list, specific documents and partial lecture notes shall be handed out during the lecture.

# T 3.247 Course: Mechanics in Microtechnology [T-MACH-105334]

**Responsible:** Dr. Christian Greiner
Dr. Patric Gruber

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181710 | Mechanics in Microtechnology | 2 SWS | Lecture (V) | Gruber, Greiner, Brandl, Schwaiger |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105334 | Mechanics in Microtechnology | | Prüfung (PR) | Gruber |
| WS 18/19 | 76-T-MACH-105334 | Mechanics in Microtechnology | | Prüfung (PR) | Gruber |

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

**Prerequisites**
none

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

## V Mechanics in Microtechnology

2181710, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. Introduction: Application and Processing of Microsystems
2. Scaling Effects
3. Fundamentals: Stress and Strain, (anisotropic) Hooke's Law
4. Fundamentals: Mechanics of Beams and Membranes
5. Thin Film Mechanics: Origin and Role of Mechanical Stresses
6. Characterization of Mechanical Properties of Thin Films and Small Structures: Measurement of Stresses and Mechnical Parameters such as Young'sModulus and YieldDtrength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Elektrostatics,...
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Elektromagnetic Actuation,…

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

**Literature**
Folien,
1. M. Ohring: "The Materials Science of Thin Films", Academic Press, 1992
2. L.B. Freund and S. Suresh: "Thin Film Materials"
3. M. Madou: Fundamentals of Microfabrication", CRC Press 1997
4. M. Elwenspoek and R. Wiegerink: "Mechanical Microsensors" Springer Verlag 2000
5. Chang Liu: Foundations of MEMS, Illinois ECE Series, 2006

## T 3.248 Course: Mechanics of Laminated Composites [T-MACH-108717]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161983 | Mechanics of laminated composites | 2 SWS | Lecture (V) | Schnack |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108717 | Mechanics of Laminated Composites | | Prüfung (PR) | |

**Competence Certificate**
Oral exam, approx. 20 minutes

**Prerequisites**
none

**Annotation**
The lecture notes are made available via ILIAS.

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

### V Mechanics of laminated composites
2161983, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Definition of composites, definition of static and kinematic groups. Definition of material laws. Transformation of the state values of composites and transformation of the material properties for the coordinate systems in the design of machine structures.

**Workload**
Contact time: 22.5 hrs; Self-study: 97.5 hrs

## T 3.249 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-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2305261 | Bildgebende Verfahren in der Medizin I | 2 SWS | Lecture (V) | Dössel |
| **Exams** | | | | | |
| WS 18/19 | 7305261 | Medical Imaging Techniques I | | Prüfung (PR) | Dössel |

**Prerequisites**
none

## T 3.250 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-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2305262 | Medical Imaging Techniques II | 2 SWS | Lecture (V) | Dössel |
| **Exams** | | | | | |
| SS 2018 | 7305262 | Medical Imaging Techniques II | | Prüfung (PR) | Dössel |
| WS 18/19 | 7305262 | Medical Imaging Techniques II | | Prüfung (PR) | Dössel |

## T 3.251 Course: Medical Robotics [T-INFO-101357]

**Responsible:** Prof. Dr.-Ing. Torsten Kröger
Dr. Jörg Raczkowsky

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24681 | Medical Robotics | 2 SWS | Lecture (V) | Raczkowsky |
| **Exams** | | | | | |
| SS 2018 | 7500129 | Medical Robotics | | Prüfung (PR) | Raczkowsky |
| WS 18/19 | 7500129 | Medical Robotics | | Prüfung (PR) | Kröger, Raczkowsky |

# T 3.252 Course: Metal Forming [T-MACH-105177]

**Responsible:** Dr.-Ing. Thomas Herlan
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2150681 | Metal Forming | 2 SWS | Lecture (V) | Herlan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105177 | Metal Forming | | Prüfung (PR) | Schulze |
| SS 2018 | 76-T-MACH-105177-Wdh | Metal Forming - re-examination | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-105177 | Metal Forming | | Prüfung (PR) | Schulze |

**Competence Certificate**
Oral Exam (20 min)

**Prerequisites**
none

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

## V Metal Forming
2150681, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

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

**Learning 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

**Annotation**
None

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

## T 3.253 Course: Metallographic Lab Class [T-MACH-105447]

**Responsible:** Ulla Hauf
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2175590 | Metallographic Lab Class | 3 SWS | Practical course (P) | Hauf |
| WS 18/19 | 2175590 | Metallographic Lab Class | 3 SWS | Practical course (P) | Mühl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105447 | Metallographic Lab Class | | Prüfung (PR) | Heilmaier |
| WS 18/19 | 76-T-MACH-105447 | Metallographic Lab Class | | Prüfung (PR) | Heilmaier |

**Competence Certificate**
Colloquium for every experiment, about 60 minutes, protocol

**Prerequisites**
none

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

### V Metallographic Lab Class
2175590, WS 18/19, 3 SWS, Open in study portal

**Practical course (P)**

**Learning 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

**Workload**
The workload for the Metallographic Lab Class is 120 h per semester and consists of the presence during the lab course (25 h) as well as preparation and rework time at home (95 h).

**Literature**
E. Macherauch: Praktikum in Werkstoffkunde, 10th edition, 1992

H. Schumann: Metallographie, 13th edition, Deutscher Verlag für Grundstoffindustrie, 1991

Literature List will be handed out with each experiment

## T 3.254 Course: Metals [T-MACH-105468]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174598 | Metals | 3 SWS | Lecture (V) | Heilmaier |
| SS 2018 | 2174599 | Übungen zur Vorlesung "Metalle" | 1 SWS | Practice (Ü) | Heilmaier, Kauffmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105468 | Metals | | Prüfung (PR) | Heilmaier |
| WS 18/19 | 76-T-MACH-105468 | Metals | | Prüfung (PR) | Heilmaier |

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

**Prerequisites**
none

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

### V Metals
2174598, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
Regular attendance: 42 h

Self-study: 138 h

**Literature**
D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

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

### V Übungen zur Vorlesung "Metalle"
2174599, SS 2018, 1 SWS, Open in study portal

**Practice (Ü)**

**Learning 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

**Workload**
Regular attendance: 14 h

Self-study: 16 h

**Literature**

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe
P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810
R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X
E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)
E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)
H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)
J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

# T 3.255 Course: Methods and Processes of PGE - Product Generation Development [T-MACH-109192]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102718 - Produktentstehung - Entwicklungsmethodik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146176 | Methods and processes of PGE - Product Generation Development (f. Product Development - Methods of Product Development) | 3 SWS | Lecture (V) | Albers, Bursac |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-105382 | Product Development - Methods of Product Development | | Prüfung (PR) | Albers |
| SS 2018 | 76-T-MACH-105382 | Product Development - Methods of Product Development | | Prüfung (PR) | Albers, Burkardt |
| WS 18/19 | 76-T-MACH-105382 | Methods and Processes of PGE - Product Generation Engineering | | Prüfung (PR) | Albers, Burkardt |

**Competence Certificate**
Written exam (processing time: 120 min + 10 min reading time)

Auxiliaries:

- Calculator
- German dictionary (books only)

**Prerequisites**
None

**Annotation**
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

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

## V Methods and processes of PGE - Product Generation Development (f. Product Development - Methods of Product Development) Lecture (V)

2146176, SS 2018, 3 SWS, Open in study portal

**Learning 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

**Annotation**
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

**Workload**
regular attendance: 31.5 h

self-study: 148.5 h

**Literature**
Lecture documents
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag, 1993

## T 3.256 Course: Methods of Signal Processing [T-ETIT-100694]

**Responsible:** Prof. Dr.-Ing. Fernando Puente León
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2302113 | Methoden der Signalverarbeitung | 2 SWS | Lecture (V) | Puente León |
| WS 18/19 | 2302115 | Übungen zu 2302113 Methoden der Signalverarbeitung | 1+1 SWS | Practice (Ü) | Puente León, Krippner |
| **Exams** | | | | | |
| SS 2018 | 7302113 | Methods of Signal Processing | | Prüfung (PR) | Puente León |
| WS 18/19 | 7302113 | Methods of Signal Processing | | Prüfung (PR) | Puente León, Krippner |

**Prerequisites**
none

# T 3.257 Course: Micro- and nanosystem integration for medical, fluidic and optical applications [T-MACH-108809]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105032 | Micro- and nanosystem integration for medical, fluidic and optical applications | 2 SWS | Lecture (V) | Koker, Gengenbach, Sieber |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108809 | Micro- and nanosystem integration for medical, fluidic and optical applications | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
T-MACH-105695 "Selected topics of system integration for micro- and nanotechnology" must not be started.

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

## V Micro- and nanosystem integration for medical, fluidic and optical applications

**Lecture (V)**

2105032, WS 18/19, 2 SWS, Open in study portal

**Learning Content**

- Introduction to the role of system integration in the product development process
- Simplistic modeling and use of analogies in system design
- Introduction to modeling and simulation in system design
- Mechanics simulation
- Optics simulation
- Fluidics simulation
- Coupling of simulation tools
- Requirements for system integration of active implants
- Design of active implants
- Approaches to system integration of active implants
- Test methods (hermeticity, accelerated aging etc.)
- Micro-optical subsystems
- Micro-fluidic subsystems
- Self-assembly as integration process at micro and nano scale

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

## T 3.258 Course: Micro Magnetic Resonannce [T-MACH-105782]

**Responsible:** Prof. Dr. Jan Gerrit Korvink
Dr. Neil MacKinnon

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141501 | Micro Magnetic Resonance | 2 SWS | Seminar (S) | MacKinnon, Badilita, Jouda, Korvink |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105782 | Micro Magnetic Resonannce | | Prüfung (PR) | Korvink, MacKinnon |
| WS 18/19 | 76-T-MACH-105782 | Micro Magnetic Resonannce | | Prüfung (PR) | Korvink, MacKinnon |

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

**Prerequisites**
none

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

### V Micro Magnetic Resonance

2141501, WS 18/19, 2 SWS, Open in study portal

**Seminar (S)**

**Learning Content**
Nuclear magnetic resonance (NMR), or magnetic resonance in general (MR) is a powerful, non-invasive technique useful for gaining atomic level structural details on samples ranging from soluble small molecules to large membrane bound proteins. Traditional NMR hardware used for exciting the sample and detecting the signal is traditionally on the macroscale in terms of physical dimensions. Recently, miniaturization of NMR systems has developed into an active research area driven primarily by the enhanced mass sensitivity and the ability for system integration with smaller NMR detectors. In this seminar course, we will explore some of the state-of-the-art applications of micro-NMR, including visiting research laboratories within Germany active in micro-MR. A selection of representative research papers will be provided, from which each student will select one paper to learn in depth and finally present in a style as if they performed the research themselves. The course will first offer a series of introductory lectures, followed by a series of tutorial sessions in which each student may discuss with experts. Finally, individual student presentations with discussion will be held.

Topics to be offered:

- Novel micro-NMR detectors (solenoid, strip line, microslot, CMOS, printed, etc.)
- Novel nano-MR detectors (MRFM, NV centers, etc.)
- Computation (design optimization, MOR, MRI image processing, NMR spectral prediction, etc.)
- Signal enhancement strategies (hyperpolarization DNP, PHiP, Xe, refrigeration)
- System hyphenation (chromatography, flow cells, LoC, orthogonal analysis, etc.)
- Complex mixtures (metabolomics, in vivo applications on small organisms)
- Biomedical MR sensors (catheters, implantable, etc.)

**Workload**
Course participation 28 h

Preparation of own lecture 60 h

Self study time 35 h

**Literature**
Links to allliterature journal articles will be provided to the students. Example research journal sources will include Nature, Nature Communications, Science, PNAS, JMR, etc. For general reading, some recommended sources are:

- Principles of Nuclear Magnetic Resonance Microscopy, Callaghan, P (1994), Oxford University Press.
- Spin Dynamics: Basics of Nuclear Magnetic Resonance 2nd Ed., Levitt, M (2013), John Wiley & Sons.
- NMR Probeheads for Biophysical and Biomedical Experiments – Theoretical Principles, Mispelter, J; Lupu, M; Briguet, A (2006) Imperial College Press.

# T 3.259 Course: Microactuators [T-MACH-101910]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142881 | Microactuators | 2 SWS | Lecture (V) | Kohl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-101910 | Microactuators | | Prüfung (PR) | Kohl |
| WS 18/19 | 76-T-MACH-101910 | Microactuators | | Prüfung (PR) | Kohl |

**Competence Certificate**
oral exam

**Prerequisites**
none

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

## V Microactuators
2142881, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Script of ppt-slides

**Learning Content**
**-** Basic knowledge in the material science of the actuation principles

- Layout and design optimization

- Fabrication technologies

- Selected developments

- Applications

The lecture includes amongst others the following topics:

- Microelectromechnical systems: linear actuators, microrelais, micromotors
- Medical technology and life sciences: Microvalves, micropumps, microfluidic systems
- Microrobotics: Microgrippers, polymer actuators (smart muscle)
- Information technology: Optical switches, mirror systems, read/write heads

**Workload**
lecture time 1.5 h/week

self preparation: 8.5 h/week

**Literature**
- Lecture notes
- D. Jendritza, Technischer Einsatz Neuer Aktoren: Grundlagen, Werkstoffe, Designregeln und Anwendungsbeispiele, Expert-Verlag, 3. Auflage, 2008
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004
- N.TR. Nguyen, S.T. Wereley, Fundamentals and applications of Microfluidics, Artech House, Inc. 2002
- H. Zappe, Fundamentals of Micro-Optics, Cambride University Press 2010

# T 3.260 Course: Microenergy Technologies [T-MACH-105557]

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

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142897 | Microenergy Technologies | 2 SWS | Lecture (V) | Kohl |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105557 | Microenergy Technologies | | Prüfung (PR) | Kohl |
| WS 18/19 | 76-T-MACH-105557 | Microenergy Technologies | | Prüfung (PR) | Kohl |

**Competence Certificate**
Oral examination (30 Min.)

**Prerequisites**
none

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

## V Microenergy Technologies

2142897, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
time of attendance: 1.5 hours/week

Self-study: 8.5 hours/week

**Literature**
- Lecture notes (overhead transparencies) "Micro Energy Technologies"
- Stephen Beeby, Neil White, Energy Harvesting for Autonomous Systems, Artech House, 2010
- Shashank Priya, Daniel J. Inman, Energy Harvesting Technologies, Springer, 2009

# T 3.261 Course: Microstructure Characteristics Relationships [T-MACH-105467]

**Responsible:** Dr. Patric Gruber
Prof. Dr. Oliver Kraft

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2178124 | Microstructure Characteristics Relationships | 3 SWS | Lecture (V) | Gruber |
| SS 2018 | 2178125 | Microstructure Characteristics Relationships (Tutorial) | 1 SWS | Practice (Ü) | Gruber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105467 | Mechanical Characteristics and Microstructure Characteristics Relationships | | Prüfung (PR) | Kraft, Gruber |
| WS 18/19 | 76-T-MACH-105467 | Mechanical Characteristics and Microstructure Characteristics Relationships | | Prüfung (PR) | Kraft, Gruber |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none

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

## V Microstructure Characteristics Relationships

2178124, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The following subjects are treated for the different material classes:

- plasticity
- fracture mechanics: experimental methods and analytical description of crack propagation and material behaviour at cracks
- fatigue: cyclic plasticity, riss initiation and propagation, damage analysis
- creep:time dependent plastic deformation and creep fracture

Besides the description of the material behaviour an overview of the corresponding experimental methods for mechanical characterisation will be given.

## T 3.262 Course: Microsystem product design for young entrepreneurs [T-MACH-105814]

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

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 6 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141503 | Microsystem product design for young entrepreneurs | 4 SWS | Practical course (P) | Korvink, Mager |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105814 | Microsystem product design for young entrepreneurs | | Prüfung (PR) | Mager, Korvink |
| WS 18/19 | 76-T-MACH-105814 | Microsystem product design for young entrepreneurs | | Prüfung (PR) | Korvink, Mager |

**Competence Certificate**
The class is a laboratory course that is taken in groups, hence the active and productive participation in the team effort is evaluated. To check the individual performance, there will be weekly discussions about the project. To evaluate each group's progress, there will be 2 presentation during the duration of the course. The final mark is determined from the marks obtained in the presentation and an oral group examination of 1 hour.

**Prerequisites**
none

# T 3.263 Course: Microsystem Simulation [T-MACH-108383]

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

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142875 | Microsystem Simulation | 3 SWS | Lecture / Practice (VÜ) | Korvink |

**Competence Certificate**
written exam

**Prerequisites**
none

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

## V Microsystem Simulation

2142875, SS 2018, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
This lecture consists of the following 12 topics, one presented each week of semester:

1. The Act of Modelling
2. Mathematica Introduction
3. Equation Types
4. Approximation and Integration
5. Differentiation and Finite Differences
6. Geometry and Meshing
7. Weighted Residual Methods
8. Finite Element Method
9. Numerical Solving
10. Computational Post-processing
11. Program Structure
12. Commercial Programs

Attendees will first learn how to approach the modelling process. Afterwards, they will learn the fundamental numerical mathematics techniques with which to form numerical simulation models, which in turn will lead to computational programs. The lecture offers one hour of exercises where students can consult the lecturers on the topics of the lecture. Students are offered numerous learning goals per chapter, to simplify the attendence of lectures.

Students are expected to work with the program Mathematica ® to complete their exercises. It provides a symbolical and numerical environment, and offers high level graphics for ease of programming. All programming exercises will be in Mathematica ®, so as to speed up the learning process.

The written examination questions draw from the examples provided during the lecture (recorded on the slides and on the black board during class) as well as from the exercises.

**Annotation**
Examinations take place during the lecture free periods. The dates are provided at the beginning of semester.

**Workload**
lectures: 30 hours

self study: 60 hours

preparation for examination: 30 hours

**Literature**
The following references are usedby the lecturers to prepare the lecture.Students are not required to access most of these, but of course it does not hurt! Hints for efficient further reading, depending on interest, will be provided during the lecture.


- E. Buckingham, On physically similar systems: illustrations on the use of dimensional equations, Phys. Rev. 4, 345–376 (1914)
- E. Buckingham, Model Experiments and the Forms of Empirical Equations, ASME 263–296 (1915)
- K. Eriksson, D. Estep, P. Hansbo, C. Johnson, Computational Differential Equations, Cambridge University Press, Cambridge (1996)
- Bengt Fornberg, Calculation of Weights in Finite Difference Formulas, SIAM Rev. 40(3) 1998
- Gene H. Golub, Charles F. van Loan, Matrix Computations, John Hopkins University Press 1996
- H. Hanche-Olsen, Buckingham's pi-theorem, Internet (2004)
- Arieh Iserles, A First Course in the Numerical Analysis of Differential Equations, Cambridge University Press, Cambridge (1996)
- Mathematica Help Documentation
- N. Metropolis, A.W. Rosenbluth, M.N. Rosenbluth. A.H. Teller and E. Teller, "Equation of State Calculations by Fast Computing Machines, J. Chem. Phys. 21 (1953) 1087-1092.
- Rick Beatson and Leslie Greengard, A short course on fast multipole methods

## T 3.264 Course: Miniaturized Heat Exchangers [T-MACH-108613]

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

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142880 | Miniaturized Heat Exchangers | 2 SWS | Lecture (V) | Brandner |

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

**Prerequisites**
none

# T 3.265 Course: Mobile Machines [T-MACH-105168]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114073 | Mobile Machines | 4 SWS | Lecture (V) | Geimer, Geiger |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-105168 | Mobile Machines | | Prüfung (PR) | Geimer |
| SS 2018 | 76-T-MACH-105168 | Mobile Machines | | Prüfung (PR) | Geimer |
| WS 18/19 | 76T-MACH-105168 | Mobile Machines | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105168 | Mobile Machines | | Prüfung (PR) | Geimer |

**Competence Certificate**
The assessment consists of an oral exam (45 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**
none

**Recommendation**
Knowledge in Fluid Power Systems is required. It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

**Annotation**
After completion of the course the students have knowledge of:

- a wide range of mobile machines
- operation modes and working cycles of importmant mobile machines
- selected subsystems and components

Content:

- Introduction of the required components and machines
- Basics and structure of mobile machines
- Practical insight in the development techniques

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

## V Mobile Machines

2114073, SS 2018, 4 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
Lecture notes.

**Learning Content**

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

**Workload**

- regular attendance: 42 hours
- self-study: 184 hours

## T 3.266 Course: Model Based Application Methods [T-MACH-102199]

**Responsible:** Dr. Frank Kirschbaum
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| SS 2018 | 76-T-MACH-102199 | Model Based Application Methods | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-102199 | Model Based Application Methods | Prüfung (PR) | Koch |

**Competence Certificate**
take-home exam, short presentation with oral examination

**Prerequisites**
none

# T 3.267 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-102592 - Modellbildung und Simulation

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 7 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2185227 | Modelling and Simulation | 2 SWS | Lecture (V) | Proppe, Furmans, Pritz, Geimer |
| WS 18/19 | 2185228 | Übungen zu Modellbildung und Simulation | 2 SWS | Practice (Ü) | Proppe, Bykov, Pritz, Völker, Furmans, Bolender, Oestringer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105297 | Modeling and Simulation | | Prüfung (PR) | Geimer, Furmans, Proppe |
| WS 18/19 | 76-T-MACH-105297 | Modeling and Simulation | | Prüfung (PR) | Furmans, Geimer, Proppe |

**Competence Certificate**
The assessment consists of a 180 minutes written examination.

**Prerequisites**
none

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

## V Modelling and Simulation

2185227, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

presentations

**Learning 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

**Annotation**
none

**Workload**
regular attendance: 42 hours
self-study: 168 hours

**Literature**
None.

## T 3.268 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2167523 | Modeling of Thermodynamical Processes | 3 SWS | Lecture (V) | Maas, Schießl |
| WS 18/19 | 2167523 | Modeling of Thermodynamical Processes | 3 SWS | Lecture (V) | Schießl, Maas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105396 | Modeling of Thermodynamical Processes | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105396 | Modeling of Thermodynamical Processes | | Prüfung (PR) | Maas |

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

**Prerequisites**
none

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

### V Modeling of Thermodynamical Processes
2167523, SS 2018, 3 SWS, Open in study portal — **Lecture (V)**

**Learning 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)

**Workload**
regular attendance: 32 hours

Self-study, exam preporation, Prüfungsvorleistung: 150,0 hours

**Literature**
Lecture notes

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

### V Modeling of Thermodynamical Processes
2167523, WS 18/19, 3 SWS, Open in study portal — **Lecture (V)**

**Learning 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)

**Workload**
regular attendance: 33.8 h

Self-study, exam preporation, Prüfungsvorleistung: 146.3 h

**Literature**
Lecture notes

Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

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

## T 3.269 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2183703 | Modelling and Simulation | 2+1 SWS | Lecture / Practice (VÜ) | Nestler |
| WS 18/19 | 2183703 | Numerical methods and simulation techniques | 3 SWS | Lecture / Practice (VÜ) | Nestler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100300 | Modelling and Simulation | | Prüfung (PR) | Nestler |
| WS 18/19 | 76-T-MACH-100300 | Modelling and Simulation | | Prüfung (PR) | Nestler |

**Competence Certificate**
Written exam, 90 min

**Prerequisites**
none

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

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

### V Modelling and Simulation
2183703, SS 2018, 2+1 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

Slides and black board. The slides will be provided as a manuscript for the course.

**Learning 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

**Workload**
regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

**Literature**

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

## V Numerical methods and simulation techniques

2183703, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

Slides and black board. The slides will be provided as a manuscript for the course.

**Learning Content**
The course gives an introduction to modelling and simulation techniques.

The following topics are included:

- polynom interpolation methods, splines, Taylor series
- zero point algorithms
- regression methods
- numerical differentiation and integration
- finite difference method
- dynamical systems, ordinary partial differential equations
- numerics of partial differential equations
- mass and heat diffusion equation
- computer lab in the programming language C, practical exercises

In parallel to the lecture, regular exercise sheets are provided and discussed. In addition, the course will be accompanied by practical exercises at the computer. Precondition to register for the written exam is the successful participation in the accompanying computer lab by presenting the solved excercise sheets at the PC.

**Workload**
regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

**Literature**

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

## T 3.270 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2183702 | Modelling of Microstructures | 3 SWS | Lecture / Practice (VÜ) | August, Nestler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105303 | Modelling of Microstructures | | Prüfung (PR) | August, Nestler, Weygand |
| WS 18/19 | 76-T-MACH-105303 | Modelling of Microstructures | | Prüfung (PR) | August, Nestler, Weygand |

**Competence Certificate**
oral exam 30 min

**Prerequisites**
none

**Recommendation**
materials science
fundamental mathematics

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

### V Modelling of Microstructures

2183702, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

Black board and slides.

**Learning 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

**Workload**
regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

**Literature**


1. Gottstein, G. (2007) Physikalische Grundlagen der Materialkunde. Springer Verlag Berlin Heidelberg
2. Kurz, W. and Fischer, D. (1998) Fundamentals of Solidification. Trans Tech Publications ltd, Switzerland Germany UK USA
3. Porter, D.A. Eastering, K.E. and Sherif, M.Y. (2009) Phase transformation in metals and alloys (third edition). CRC Press, Taylor & Francis Group, Boca Raton, London, New York
4. Gaskell, D.R., Introduction to the thermodynamics of materials
5. Problem sheets

## T 3.271 Course: Modern Control Concepts I [T-MACH-105539]

**Responsible:** Dr. Lutz Groell
PD Dr.-Ing. Jörg Matthes

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2105024 | Modern Control Concepts I | 2 SWS | Lecture (V) | Matthes, Groell |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105539 | Modern Control Concepts I | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105539 | Modern Control Concepts I | | Prüfung (PR) | Hagenmeyer |

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

### Prerequisites
none

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

## V Modern Control Concepts I
2105024, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

### Learning Content

1. Introduction (classification, overviews, model simplification)
2. Simulation and analysis of dynamical systems with Matlab
3. Linearisation (equilibrium manifold, low-delta-method, Hartman-Grobman-theorem, design methodology for linear setpoint controller)
4. Two-degree-of-freedom control (structure, reference signal design)
5. PID-Controller (practical realisation, design hints, anti-windup-methods, Smith-predictor, switching technics, complex example)
6. Multi variable control and advanced control structures
7. State space (geometric view, role of zeros)
8. Tracking control with state feedback and supplemental integrator
9. Observer (LQG-design, disturbance observer, reduced observer)
10. Limits of control (existence subject, limits in time and frequency domain)

### Workload
General attendance: 21 h

Self-study: 99 h

### Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

# T 3.272 Course: Modern Control Concepts II [T-MACH-106691]

**Responsible:** Dr. Lutz Groell
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2106032 | Modern Control Concepts II | 2 SWS | Lecture (V) | Groell |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106691 | Modern Control Concepts II | | Prüfung (PR) | |

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

**Prerequisites**
none

## T 3.273 Course: Modern Control Concepts III [T-MACH-106692]

**Responsible:** Dr. Lutz Groell
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2106035 | Modern Control Concepts III | 2 SWS | Lecture (V) | Groell |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106692 | Modern Control Concepts III | | Prüfung (PR) | |

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

**Prerequisites**
none

## T 3.274 Course: Multi-Scale Plasticity [T-MACH-105516]

**Responsible:** Dr. Christian Greiner
Dr. Katrin Schulz

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181750 | Multi-scale Plasticity | 2 SWS | Lecture (V) | Schulz, Greiner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105516 | Multi-Scale Plasticity | | Prüfung (PR) | Schulz |
| WS 18/19 | 76-T-MACH-105516 | Multi-Scale Plasticity | | Prüfung (PR) | Schulz |

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

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

### V Multi-scale Plasticity

2181750, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

black board, beamer, script

**Learning Content**
This module will attempt to provide an overview to complex subjects in the field of material mechanics. For this purpose important scientific papers will be presented and discussed.
This will be done by having students read and critique one paper each week in a short review. In addition, each week will include presentation from one of the participants which aim to advocate or criticise each piece of work using the short reviews. He will also be the discussion leader, while students discuss the content, ideas, evaluation and open research questions of the paper. Using a professional conference management system (HotCRP), the student assume the role of reviewers and gain insight into the work of researchers.

**Annotation**
The maximum number of students is 14 per semester.

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

## T 3.275 Course: Nanotechnology for Engineers and Natural Scientists [T-MACH-105180]

**Responsible:** Prof. Dr. Martin Dienwiebel
PD Dr. Hendrik Hölscher
Stefan Walheim

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102637 - Schwerpunkt: Tribologie
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142861 | Nanotechnology for Engineers and Natural Scientists | 2 SWS | Lecture (V) | Hölscher, Dienwiebel, Walheim |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | | Prüfung (PR) | Hölscher, Dienwiebel |
| WS 18/19 | 76-T-MACH-105180 | Nanotechnology for Engineers and Natural Scientists | | Prüfung (PR) | Hölscher, Dienwiebel |

**Competence Certificate**
written exam 90 min

**Prerequisites**
none

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

### V Nanotechnology for Engineers and Natural Scientists

2142861, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1) Introduction into nanotechnology
2) History of scanning probe techniques
3) Scanning tunneling microscopy (STM)
4) Atomic force microscopy (AFM)
5) Dynamic Modes (DFM, ncAFM, MFM, KPFM, ...)
6) Friction force microscopy & nanotribology
7) Nanolithography
8) Other families of the SPM family

**Workload**
lectures 30 h

self study 30 h

preparation for examination 30 h

**Literature**

1. Lecture notes, slides, script
2. Scanning Probe Microscopy – Lab on a Tip: Meyer, Hug, Bennewitz, Springer (2003)

# T 3.276 Course: Nanotribology and -Mechanics [T-MACH-102167]

**Responsible:** Prof. Dr. Martin Dienwiebel
PD Dr. Hendrik Hölscher

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 3 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182712 | Nanotribology and -Mechanics | 2 SWS | Block lecture (BV) | Dienwiebel |
| WS 18/19 | 2182712 | Nanotribology and -Mechanics | 2 SWS | Block lecture (BV) | Dienwiebel |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102167 | Nanotribology and -Mechanics | | Prüfung (PR) | Dienwiebel |
| WS 18/19 | 76-T-MACH-102167 | Nanotribology and -Mechanics | | Prüfung (PR) | Dienwiebel |

**Competence Certificate**
presentation (40%) and oral examination (30 min, 60%)

no tools or reference materials

**Prerequisites**
none

**Recommendation**
preliminary knowlegde in mathematics and physics

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

## V Nanotribology and -Mechanics

2182712, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**
Part 1: Basics:

- Nanotechnology
- Forces at nanometer scale
- contact mechanics models (Hertz, JKR, DMT)
- Experimental methods (SFA, QCM, FFM)
- Prandtl-Tomlinson model
- Superlubricity
- Atomic-Scale Wear

Part 2: Topical papers

**Workload**
regular attendance: 22,5 hours
preparation for presentation: 22,5 hours
self-study: 75 hours

**Literature**
Edward L. Wolf
Nanophysics and Nanotechnology, Wiley-VCH, 2006

C. Mathew Mate
Tribology on the Small Scale: A Bottom Up Approach to Friction, Lubrication, and Wear (Mesoscopic Physics and Nanotechnology) 1st Edition, Oxford University Press

Lecture notes, slides and copies of articles

## V Nanotribology and -Mechanics

2182712, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**
Part 1: Basics:

- Nanotechnology
- Forces at nanometer scale
- contact mechanics models (Hertz, JKR, DMT)
- Experimental methods (SFA, QCM, FFM)
- Prandtl-Tomlinson model
- Superlubricity
- Atomic-Scale Wear

Part 2: Topical papers

**Workload**
regular attendance: 22,5 hours
preparation for presentation: 22,5 hours
self-study: 75 hours

**Literature**
Lecture notes, slides and copies of articles

## T 3.277 Course: Neurovascular Interventions (BioMEMS V) [T-MACH-106747]

**Responsible:** Dr.-Ing. Giorgio Cattaneo
Prof. Dr. Andreas Guber

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141103 | BioMEMS V - Neurovascular Interventions | 2 SWS | Lecture (V) | Cattaneo, Guber |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106747 | Neurovascular Interventions (BioMEMS V) | | Prüfung (PR) | Guber |

**Competence Certificate**
oral exam (30 Min.)

**Prerequisites**
none

## T 3.278 Course: Neutron Physics of Fusion Reactors [T-MACH-105435]

**Responsible:** Dr. Ulrich Fischer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189473 | Neutron physics of fusion reactors | 2 SWS | Lecture (V) | Fischer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105435 | Neutron Physics of Fusion Reactors | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105435 | Neutron physics of fusion reactors | | Prüfung (PR) | Stieglitz |

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

**Prerequisites**
none

**Annotation**
none

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

### V Neutron physics of fusion reactors

2189473, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Nuclear interaction processes and energy release

Chain reaction and criticality

Neutron transport, Boltzmann equation

Diffusion approximation, Monte Carlo method

Neutronic reactor design

**Workload**
regular attendance: 21 h
self-study: 42 h

**Literature**
K. H. Beckurts, K. Wirtz, Neutron Physics, Springer Verlag, Berlin, Germany (1964)

W. M. Stacey, Nuclear Reactor Physics, John Wiley & Sons, Wiley-VCH, Berlin(2007)

J. Raeder (Ed.), Kontrollierte Kernfusion. Grundlagen ihrer Nutzung zur Energieversorgung, Teubner, Stuttgart (1981)

# T 3.279 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-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142551 | NMR micro probe hardware conception and construction | 2 SWS | Practical course (P) | Korvink, Jouda |

**Competence Certificate**
Successful participation.

**Prerequisites**
none

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

## V NMR micro probe hardware conception and construction

2142551, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Description**
The aim of this practical block course is to familiarize the students with magnetic resonance imaging as a substantial non-invasive non-destructive imaging technique that is widely used for medical diagnosis.

It is also to give them hands-on experience on how to build the MRI probe from A to Z including

- Mechanical design
- High frequency electrical circuitry
- Testing on a commercial MRI scanner

**Learning Content**
In order to prepare attendees, the following chapters will be offered, spread over the week as lecture units, and accompanying the practical work:

- Theory of magnetic resonance imaging

-The MRI probe and the principle of reciprocity

- RF resonators

- Coaxial cables and cable traps

- Tuning and matching the MRI probe

- Effects of material susceptibility

- The mechanical support of the MRI probe

- Introduction to ParaVision, the MRI imaging software.

## T 3.280 Course: Nonlinear Continuum Mechanics [T-MACH-105532]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102649 - Schwerpunkt: Advanced Materials Modelling

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162344 | Nonlinear Continuum Mechanics | 2 SWS | Lecture (V) | Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105532 | Nonlinear Continuum Mechanics | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105532 | Nonlinear Continuum Mechanics | | Prüfung (PR) | Böhlke |

**Competence Certificate**
oral examination

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

### V Nonlinear Continuum Mechanics
2162344, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- tensor calculus, kinematics, balance equations
- principles of material theory
- finite elasticity
- infinitesimal elasto(visco)plasticity
- exact solutions ov infinitesimal Platicity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure
- strain localization

**Workload**
regular attendance: 31,5 hours
self-study: 118 hours

**Literature**
lecture notes

Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
Liu, I-S.: Continuum Mechanics. Springer 2002.
Schade, H.: Tensoranalysis.Walter de Gruyter 1997.
Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer 2001.

## T 3.281 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-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141865 | Novel actuators and sensors | 2 SWS | Lecture (V) | Kohl, Sommer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102152 | Novel Actuators and Sensors | | Prüfung (PR) | Sommer, Kohl |
| WS 18/19 | 76-T-MACH-102152 | Novel Actuators and Sensors | | Prüfung (PR) | Kohl, Sommer |

**Competence Certificate**
oral exam (30 Min.)

**Prerequisites**
none

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

### V Novel actuators and sensors

2141865, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Script / script of ppt foils (part 2)

**Learning Content**
**Contents: -** Basic knowledge in the material science of actuator and sensor principles

- Layout and design optimization

- Fabrication technologies

- Selected developments

- Applications

**Index:** The lecture includes amongst others the following topics:

- Piezo actuators
- Magnetostrictive actuators
- Shape memory actuators
- Electro-/magnetorheological actuators
- Sensors: Concepts, materials, fabrication
- Micromechanical sensors: Pressure, force, inertia sensors
- Temperature sensors
- Micro sensors for bio analytics
- Mechano-magnetic sensors

The lecture addresses students in the fields of mechanical engineering, mechatronics and information technology, materials science and engineering, electrical engineering and economic sciences. A comprehensive introduction is given in the basics and current developments on the macroscopic length scale.

The lecture is core subject of the major course "Actuators and Sensors" of the specialization "Mechatronics and Microsystems Technology" in Mechanical Engineering.

**Workload**
**Work Lecture:**

time of attendance: 21 hours

Self-study: 99 hours

**Literature**
- Lecture notes

- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007

- "Sensors Update", Edited by H.Baltes, W. Göpel, J. Hesse, VCH, 1996, ISBN: 3-527-29432-5

- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

## T 3.282 Course: Nuclear Medicine and Measuring Techniques I [T-ETIT-100664]

**Responsible:** Prof. Dr. Olaf Dössel
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 1 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2305289 | Nuklearmedizin und nuklearmedizinische Messtechnik I | 1 SWS | Lecture (V) | Maul, Doerfel |
| **Exams** | | | | | |
| WS 18/19 | 7305289 | Nuclear Medicine and Measuring Techniques I | | Prüfung (PR) | Maul |

**Prerequisites**
none

## T 3.283 Course: Nuclear Power Plant Technology [T-MACH-105402]

**Responsible:** Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng
Prof. Dr.-Ing. Thomas Schulenberg

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2170460 | Nuclear Power Plant Technology | 2 SWS | Lecture (V) | Cheng, Schulenberg |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105402 | Nuclear Power Plant Technology | | Prüfung (PR) | Schulenberg |
| WS 18/19 | 76-T-MACH-105402 | Nuclear Power Plant Technology | | Prüfung (PR) | Schulenberg |

**Competence Certificate**
oral exam, Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

**Prerequisites**
none

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

### V Nuclear Power Plant Technology
2170460, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
Powerpoint presentations

PWR simulator

BWR simulator

**Learning Content**
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

**Annotation**
Recommendations:

Knowledge of thermodynamics are a mandatory requirement for this course.

Basic knowledge of the physics of nuclear fission wiill be helpful.

Simulator exercises with a simplified pressurized water reactor and a simplified boiling water reactor are offered to ease understanding of thermodynamics and neutron physics.

**Workload**
regular attendance: 48 h
self-study: 72 h

**Literature**
lecture notes

# T 3.284 Course: Numerical Fluid Mechanics [T-MACH-105338]

**Responsible:** Dr.-Ing. Franco Magagnato
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2153441 | Numerical Fluid Mechanics | 2 SWS | Lecture (V) | Magagnato |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105338 | Numerical Fluid Mechanics | | Prüfung (PR) | Gabi |
| WS 18/19 | 7600004 | Numerical Fluid Mechanics | | Prüfung (PR) | Frohnapfel, Magagnato |
| WS 18/19 | 76-T-MACH-105338 | Computational Methods in Fluid Mechanics | | Prüfung (PR) | Magagnato |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none

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

## V Numerical Fluid Mechanics
2153441, WS 18/19, 2 SWS, Open in study portal **Lecture (V)**

**Description**
**Media:**
"Powerpoint presentation", Beamer

**Learning Content**
1. Governing Equations of Fluid Dynamics
2. Discretization
3. Boundary and Initial conditions
4. Turbulence Modelling
5. Mesh Generation
6. Numerical Methods
7. LES, DNS and Lattice Gas Methods
8. Pre- and Postprocessing
9. Examples of Numerical Methods for Industrial Applications

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

**Literature**
Ferziger, Peric: Computational Methods for Fluid Dynamics. Springer-Verlag, 1999.
Hirsch: Numerical Computation of Internal and External Flows. John Wiley & Sons Inc., 1997.
Versteg, Malalasekera: An introduction to computational fluid dynamics. The finite volume method. John Wiley & Sons Inc., 1995

## T 3.285 Course: Numerical Fluid Mechanics with MATLAB [T-MACH-105453]

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

**Part of:** M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154409 | Numerical Fluid Mechanics with MATLAB | 2 SWS | Practical course (P) | Frohnapfel, Gatti, Stroh |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105453 | Numerical Fluid Mechanics with MATLAB | | Prüfung (PR) | Frohnapfel, Gatti |
| WS 18/19 | 76-T-MACH-105453 | Numerical Fluid Mechanics with MATLAB | | Prüfung (PR) | |

**Competence Certificate**
ungraded homework

**Prerequisites**
none

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

### V Numerical Fluid Mechanics with MATLAB
2154409, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Description**
**Media:**

Power Point, workstations: independent programming

**Learning Content**
Numerical Fluid Mechanics with Matlab

- Introduction to Numerics and Matlab
- Finite-Difference-Method
- Finite-Volume-Method
- boundary conditions and intial conditions
- explicit and implicite schemes
- pressure correction

**Annotation**
Block course with limited number of participants, registration in the secretary's office required. See details at www.istm.kit.edu

**Workload**
attendance: 20h

self-study: 100h

**Literature**
H. Ferziger, M. Peric, *Computational Methods for Fluid Dynamics*, Springer, 2008

## T 3.286 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-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102594 - Mathematische Methoden
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 0187400 | Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen | 2 SWS | Lecture (V) | Wieners |
| SS 2018 | 0187500 | Übungen zu 0187400 | 1 SWS | Practice (Ü) | Wieners |
| **Exams** | | | | | |
| SS 2018 | 0100085 | Numerical Mathematics for Students of Computer Science | | Prüfung (PR) | Wieners |
| WS 18/19 | 6700011 | Numerical Mathematics for Students of Computer Science | | Prüfung (PR) | Wieners |

**Competence Certificate**
written exam, 120 min.

**Prerequisites**
none

## T 3.287 Course: Numerical Mechanics for Industrial Applications [T-MACH-108720]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108720 | Numerical Mechanics for Industrial Applications | Prüfung (PR) | |

**Competence Certificate**
Oral exam, 20 minutes

**Prerequisites**
None

# T 3.288 Course: Numerical Methods for combustion process development [T-MACH-105716]

**Responsible:** Dr.-Ing. Heiko Kubach
Dr.-Ing. Ulf Waldenmaier

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2133130 | Numerical Methods for combustion process development | 1 SWS | Block lecture (BV) | Waldenmaier |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105716 | Numerical Methods for combustion process development | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105716 | Numerical Methods for combustion process development | | Prüfung (PR) | Koch |

**Competence Certificate**
oral exam, 15 min

**Prerequisites**
none

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

## V Numerical Methods for combustion process development

2133130, WS 18/19, 1 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**
Introduction

Working process calculation

Pressure trace analysis

Overall system

Combustion simulation

further CFD applications

Validation methods

**Workload**
regular attendance: 14 hours
self-study: 46 hours

# T 3.289 Course: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

**Responsible:** Dr. Martin Wörner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2130934 | Numerical Modeling of Multiphase Flows | 2 SWS | Lecture (V) | Wörner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | | Prüfung (PR) | Frohnapfel |
| WS 18/19 | 76-T-MACH-105420 | Numerical Simulation of Multi-Phase Flows | | Prüfung (PR) | |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

## V Numerical Modeling of Multiphase Flows

2130934, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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)

**Annotation**
For some topics of the lecture exercises are provided (working on them is optional).

**Workload**
regular attendance: 21h

self-study: 99h

**Literature**
A brief script can be downloaded from http://bibliothek.fzk.de/zb/berichte/FZKA6932.pdf.

Powerpoint presentations can be downloaded after each lecture from the ILIAS system.

A list of recommended books is provided in the first lecture.

# T 3.290 Course: Numerical Simulation of Reacting Two Phase Flows [T-MACH-105339]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169458 | Numerical simulation of reacting two phase flows | 2 SWS | Lecture (V) | Koch |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | | Prüfung (PR) | Koch |
| WS 18/19 | 76-T-MACH-105339 | Numerical Simulation of Reacting Two Phase Flows | | Prüfung (PR) | Koch |

**Competence Certificate**
Oral exam
Duration: approximately 30 minutes

no tools or reference materials are allowed

**Prerequisites**
none

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

## V Numerical simulation of reacting two phase flows

2169458, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The course is devoted to diploma/master students and doctoral candidates of mechanical and chemical engineering. It gives an overview of the numerical methods used for CFD of single and two phase flows. The course introduces methods for reacting single and two phase flows, as they are typically found in gas turbines and piston engines operated by liquid fuel.

1. Single phase flow: Basic equations of fluid dynamics, Turbulence: DNS, LES, RANS; Finite volume methods, Numerical solvers.

2. Two phase flows: Basics of atomisation, Characterisation of sprays, Numerical prediction of droplet movement, Numerical methods for predicitng of liquid disintegration (VoF, SPH), Numerical methods for secondary atomisation; Droplet evaporation

3. Reacting flows: Combustion models; Single droplet combustion, Spray combustion.

**Workload**
regular attendance: 21 h
self-study: 42 h

**Literature**
Lecture notes

## T 3.291 Course: Numerical Simulation of Turbulent Flows [T-MACH-105397]

**Responsible:** Dr. Günther Grötzbach
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102604 - Schwerpunkt: Computational Mechanics
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153449 | Numerical Simulation of Turbulent Flows | 3 SWS | Lecture (V) | Grötzbach |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105397 | Numerical Simulation of Turbulent Flows | | Prüfung (PR) | Grötzbach |
| WS 18/19 | 76-T-MACH-105397 | Numerical Simulation of Turbulent Flows | | Prüfung (PR) | Grötzbach |

**Competence Certificate**
oral

Duration: 30 minutes

no auxiliary means

**Prerequisites**
none

**Recommendation**
Basics in fluid mechanics

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

### V Numerical Simulation of Turbulent Flows

2153449, WS 18/19, 3 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
black board, plus pictures, movies, and script in English (distributed chapter by chapter)

**Notes**
Duration of the lecture 3 h from 14:00 - 15:30 h and from 15:45 - 16:30 h

**Learning Content**
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

**Annotation**
Recommendations: basics in fluid mechanics

**Workload**
regulare attendance: 29h

self-study: 91h

**Literature**
J. Piquet, *Turbulent Flows – Models and Physics,* Springer, Berlin (2001)

G. Grötzbach, *Revisiting the Resolution Requirements for Turbulence Simulations in Nuclear Heat Transfer.* Nuclear Engineering & Design Vol. 241 (2011) pp. 4379-4390

P. Sagaut, C. Meneveau, *Large-eddy simulation for incompressible flows: An introduction.* Springer Verlag (2010)

G. Grötzbach,Script in English

## T 3.292 Course: Occupational Safety and Environmental Protection [T-MACH-105386]

**Responsible:** Rainer von Kiparski
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110037 | Occupational Safety and Environmental Protection (in German) | 2 SWS | Block lecture (BV) | von Kiparski |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105386 | Occupational Safety and Environmental Protection | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105386 | Occupational Safety and Environmental Protection | | Prüfung (PR) | Deml |

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

The exam is offered in German only!

**Prerequisites**
none

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

### V Occupational Safety and Environmental Protection (in German)

2110037, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning 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

**Workload**
Compact course (one week full-time).

The amount of work accounts for 120 h (=4 ECTS).

**Literature**
Handout and literature are available on ILIAS for download.

## T 3.293 Course: Optical Flow Measurement: Fundamentals and Applications [T-MACH-105424]

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel
Prof. Dr.-Ing. Friedrich Seiler

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153410 | Optical Flow Measurement: Fundamentals and Applications | 2 SWS | Lecture (V) | Seiler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105424 | Optical Flow Measurement: Fundamentals and Applications | | Prüfung (PR) | Seiler |
| WS 18/19 | 7600005 | Optical Flow Measurement: Fundamentals and Applications | | Prüfung (PR) | |
| WS 18/19 | 76-T-MACH-105424 | Optical Flow Measurement: Fundamentals and Applications | | Prüfung (PR) | |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

### V Optical Flow Measurement: Fundamentals and Applications — Lecture (V)
2153410, WS 18/19, 2 SWS, Open in study portal

**Description**
**Media:**

Power Point

**Learning Content**

- Visualisations techniques
- Techniques for local point-wise measurement
- Techniques using light scattering methods
- Laser-induced fluorescence

**Workload**
regular attendance: 21h
self-study: 99h

**Literature**
H. Oertel sen., H. Oertel jun.: Optische Strömungsmeßtechnik, G. Braun, Karlsruhe

F. Seiler: Skript zur Vorlesung über Optische Strömungsmeßtechnik

## T 3.294 Course: Organ Support Systems [T-MACH-105228]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2106008 | Organ support systems | 2 SWS | Lecture (V) | Pylatiuk |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105228 | Organ Support Systems | | Prüfung (PR) | Pylatiuk |
| WS 18/19 | 76-T-MACH-105228 | Organ Support Systems | | Prüfung (PR) | Pylatiuk |

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

**Prerequisites**
none

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

### V Organ support systems
2106008, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
General attendance: 21 h

Self-study: 99 h

**Literature**

- Jürgen Werner: Kooperative und autonome Systeme der Medizintechnik: Funktionswiederherstellung und Organersatz. Oldenbourg Verlag.
- Rüdiger Kramme: Medizintechnik: Verfahren - Systeme – Informationsverarbeitung. Springer Verlag.
- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

## T 3.295 Course: Patent Law [T-INFO-101310]

**Responsible:** Prof. Dr. Thomas Dreier
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 24656 | Patent Law | 2 SWS | Lecture (V) | Koch |
| **Exams** | | | | | |
| SS 2018 | 7500062 | Patent Law | | Prüfung (PR) | Dreier, Matz |
| WS 18/19 | 7500001 | Patent Law | | Prüfung (PR) | Dreier, Matz |

## 3.296 Course: Photovoltaic System Design [T-ETIT-100724]

**Responsible:** Robin Grab
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Version |
|---|---|---|
| Prüfungsleistung schriftlich | 3 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2307380 | Photovoltaische Systemtechnik | 2 SWS | Lecture (V) | Grab |
| **Exams** | | | | | |
| SS 2018 | 7307380 | Photovoltaics | | Prüfung (PR) | Leibfried |
| WS 18/19 | 7307380 | Photovoltaic System Design | | Prüfung (PR) | Leibfried |

**Prerequisites**
none

## T 3.297 Course: Photovoltaics [T-ETIT-101939]

**Responsible:** Prof. Dr.-Ing. Michael Powalla
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2313737 | Photovoltaics | 4 SWS | Lecture (V) | Powalla, Lemmer |
| **Exams** | | | | | |
| SS 2018 | 7313737 | Photovoltaics | | Prüfung (PR) | Powalla, Lemmer |
| WS 18/19 | 7313737 | Photovoltaics | | Prüfung (PR) | Powalla, Lemmer |

**Prerequisites**
"M-ETIT-100524 - Solar Energy" must not have started.

## T 3.298 Course: Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle [T-MACH-105537]

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

**Part of:** M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each winter term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2189906 | Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle | 1 SWS | Lecture (V) | Dagan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105537 | Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle | | Prüfung (PR) | Stieglitz, Dagan |
| WS 18/19 | 76-T-MACH-105537 | Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle | | Prüfung (PR) | Dagan, Stieglitz |

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

**Prerequisites**
none

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

### V Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle

**Lecture (V)**

2189906, WS 18/19, 1 SWS, Open in study portal

**Learning 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

**Workload**

Regular attendance: 14 h

self study 46 h

**Literature**

AEA- Open documentation of the reactor accidents

K. Wirtz: Basics of Reactor technic Par I, II, Technic School Karlsruhe 1966 (in German)

D. Emendorfer. K.H. Höcker: Theory of nuclear reactions, Parts I, II BI- Hochschultaschenbücher 1969 ( in German)

J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley $ Sons , Inc. 1975.

R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006

J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006

# T 3.299 Course: Physical Basics of Laser Technology [T-MACH-109084]

**Responsible:** Dr.-Ing. Johannes Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181612 | Physical basics of laser technology | 3 SWS | Lecture / Practice (VÜ) | Schneider |

**Competence Certificate**
colloquium (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-102102]

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.
2. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.

**Recommendation**
basic knowledge of physics, chemistry and material science

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

## V Physical basics of laser technology

2181612, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

lecture notes via ILIAS

**Learning Content**
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned. An excursion to the laser laboratory of the Institute for Applied Materials (IAM) will be offered.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- savety aspects

The lecture is complemented by a tutorial.

**Annotation**
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.

**Workload**
regular attendance: 33,5 hours
self-study: 146,5 hours

**Literature**
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

## T 3.300 Course: Physical Basics of Laser Technology [T-MACH-102102]

**Responsible:** Dr.-Ing. Johannes Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 5 | Each winter term | 3 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181612 | Physical basics of laser technology | 3 SWS | Lecture / Practice (VÜ) | Schneider |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102102 | Physical Basics of Laser Technology | | Prüfung (PR) | Schneider |
| WS 18/19 | 76-T-MACH-102102 | Physical Basics of Laser Technology | | Prüfung (PR) | Schneider |

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

no tools or reference materials

**Prerequisites**
It is not possible, to combine this brick with brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.
2. The course T-MACH-109084 - Physical Basics of Laser Technology must not have been started.

**Recommendation**
Basic knowledge of physics, chemistry and material science

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

### V Physical basics of laser technology
2181612, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Description**
**Media:**

lecture notes via ILIAS

**Learning Content**
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned. An excursion to the laser laboratory of the Institute for Applied Materials (IAM) will be offered.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- savety aspects

The lecture is complemented by a tutorial.

**Annotation**
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.

**Workload**
regular attendance: 33,5 hours
self-study: 146,5 hours

**Literature**
W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

# T 3.301 Course: Physics for Engineers [T-MACH-100530]

**Responsible:** Prof. Dr. Martin Dienwiebel
Prof. Dr. Peter Gumbsch
Prof. Dr. Alexander Nesterov-Müller
Dr. Daniel Weygand

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142890 | Physics for Engineers | 2 SWS | Lecture (V) | Weygand, Dienwiebel, Nesterov-Müller, Gumbsch |
| SS 2018 | 8030087 | Nachklausur „Physik für Ingenieure“ | SWS | Written exam | Dienwiebel |
| **Exams** | | | | | |
| SS 2018 | 7600002 | Physics for Engineers | | Prüfung (PR) | Dienwiebel, Nesterov-Müller |
| SS 2018 | 7600009 | Physics for Engineers | | Prüfung (PR) | Dienwiebel, Nesterov-Müller |
| SS 2018 | 76-T-MACH-100530 | Physics for Engineers | | Prüfung (PR) | Gumbsch, Weygand, Nesterov-Müller, Dienwiebel |
| WS 18/19 | 76-T-MACH-100530 | Physics for Engineers | | Prüfung (PR) | Gumbsch, Dienwiebel, Nesterov-Müller, Weygand |

**Competence Certificate**
written exam 90 min

**Prerequisites**
none

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

## V Physics for Engineers

2142890, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1) Foundations of solid state physics

- Wave particle dualism
- Tunnelling
- Schrödinger equation
- H-atom

2) Electrical conductivity of solids

- solid state: periodic potentials
- Pauli Principle
- band structure
- metals, semiconductors and isolators
- p-n junction / diode

3) Optics

- quantum mechanical principles of the laser
- linear optics
- non-linear optics

Exercises (2142891, 2 SWS) are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students and for testing progress in learning of the topics.

**Workload**
regular attendance: 22,5 hours (lecture) and 22,5 hours (excerises 2142891)
self-study: 97,5 hours and 49 hours (excerises 2142891)

**Literature**

- Tipler und Mosca: Physik für Wissenschaftler und Ingenieure, Elsevier, 2004
- Haken und Wolf: Atom- und Quantenphysik. Einführung in die experimentellen und theoretischen Grundlagen, 7. Aufl., Springer, 2000
- Harris, Moderne Physik, Pearson Verlag, 2013

## T 3.302 Course: Planning of Assembly Systems [T-MACH-105387]

**Responsible:** Eberhardt Haller
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2109034 | Planning of Assembly Systems (in German) | 2 SWS | Block lecture (BV) | Haller |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105387 | Planning of Assembly Systems | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105387 | Planning of Assembly Systems | | Prüfung (PR) | Deml |

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

The exam is offered in German only!

**Prerequisites**
Timely pre-registration in ILIAS, since participation is limited.

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

### V Planning of Assembly Systems (in German)

2109034, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**

1. Planning guidelines
2. Vulnerability analysis
3. Planning of work systems (technical and organisational structuring principles, capacity planning, proceedence diagram, payment system)
4. Evaluation
5. Presentation

**Workload**
Compact course (one week full-time).

The amount of work accounts for 120 h (=4 ECTS).

**Literature**
Handout and literature online ILIAS.

## T 3.303 Course: PLM for Product Development in Mechatronics [T-MACH-102181]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2122376 | PLM for product development in mechatronics | SWS | Lecture (V) | Eigner |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102181 | PLM for Product Development in Mechatronics | | Prüfung (PR) | Eigner |
| WS 18/19 | 76-T-MACH-102181 | PLM for Product Development in Mechatronics | | Prüfung (PR) | Eigner |

**Competence Certificate**
Oral examination 20 min.

**Prerequisites**
none

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

### V PLM for product development in mechatronics
2122376, SS 2018, SWS, Open in study portal

**Lecture (V)**

**Workload**
The total workload for this course is approximately 120 hours. For further information see German version.

## T 3.304 Course: PLM in the Manufacturing Industry [T-MACH-105340]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| SS 2018 | 76-T-MACH-105340 | PLM in the Manufacturing Industry | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-105340 | PLM in the Manufacturing Industry | Prüfung (PR) | Ovtcharova |

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

**Prerequisites**
None

## T 3.305 Course: Plug-and-play material handling [T-MACH-106693]

**Responsible:** Jonathan Dziedzitz
Prof. Dr.-Ing. Kai Furmans

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2100001 | Plug-and-Play Material Handling | 2 SWS | Practical course (P) | Furmans, Mittwollen, Hopfgarten, Rimmele |
| WS 18/19 | 2117070 | Plug-and-play material handling | 2 SWS | Practical course (P) | Furmans, Dziedzitz |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106693 | Plug-and-play material handling | | Prüfung (PR) | Furmans |

**Competence Certificate**
Presentation of the four steps of the course content (design, implementation, test concept and evaluation)

**Prerequisites**
None

**Annotation**
Presence is obligatory

## T 3.306 Course: Polymer Engineering I [T-MACH-102137]

**Responsible:** Prof. Dr.-Ing. Peter Elsner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173590 | Polymer Engineering I | 2 SWS | Lecture (V) | Elsner, Weidenmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102137 | Polymer Engineering I | | Prüfung (PR) | Elsner |
| WS 18/19 | 76-T-MACH-102137 | Polymer Engineering I | | Prüfung (PR) | Elsner |

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

**Prerequisites**
none

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

### V Polymer Engineering I
2173590, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. Economical aspects of polymers
2. Introductiom of mechanical,
chemical end electrical properties
3. Processing of polymers
(introduction)
4. Material science of polymers
5. Synthesis

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

**Literature**
Recommended literature and selected official lecture notes are provided in the lecture

## T 3.307 Course: Polymer Engineering II [T-MACH-102138]

**Responsible:** Prof. Dr.-Ing. Peter Elsner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102632 - Schwerpunkt: Polymerengineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174596 | Polymer Engineering II | 2 SWS | Lecture (V) | Elsner, Weidenmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102138 | Polymerengineering II | | Prüfung (PR) | Elsner |
| WS 18/19 | 76-T-MACH-102138 | Polymerengineering II | | Prüfung (PR) | Elsner |

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

**Prerequisites**
none

**Recommendation**
Knowledge in Polymerengineering I

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

### V Polymer Engineering II

2174596, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**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**
Recommended literature and selected official lecture notes are provided in the lecture.

## T 3.308 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2141853 | Polymers in MEMS A: Chemistry, Synthesis and Applications | 2 SWS | Block lecture (BV) | Rapp |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102192 | Polymers in MEMS A: Chemistry, Synthesis and Applications | | Prüfung (PR) | Rapp, Worgull |
| WS 18/19 | 76-T-MACH-102192 | Polymers in MEMS A: Chemistry, Synthesis and Applications | | Prüfung (PR) | Rapp |

**Competence Certificate**
Oral examination

**Prerequisites**
none

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

### V Polymers in MEMS A: Chemistry, Synthesis and Applications
2141853, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**
The lecture slides will be given out as scriptum during each lecture course.

**Learning Content**

We all come in contact with numerous polymeric products in everyday life. From water bottles to packaging to the cover of the iPad, many things are made of polymers. Polymers are also important materials for modern microelectromechanical systems (MEMS) allowing cost effective mass market compatible products, e.g., in the life sciences or diagnostics. But polymers are not just cost-effective replacements for more expensive classical materials in MEMS (such as, e.g., silicon) – some polymers have intrinsic properties that make them ideal materials for sensors, actuators or templates for biology and chemistry in MEMS.

This lecture will introduce the basics of organic chemistry required for understanding what polymers are, how they are manufactured and which mechanisms are responsible for their unique properties. The lecture will highlight (in the context of MEMS but also in a wider scope) where and why polymers are applied with a strong focus on their chemical and physical properties (and on their synthesis).

Some of the topics covered are:

- What is the basic chemistry of polymers? What are monomers, what are macromolecules and how are they formed?
- How are polymers produced on industrial scale – but also on the laboratory scale? Numerous examples of how to make (commonly and lesser known) polymers will be discussed including materials such as Plexiglas.
- Why are polymers so important for biochemistry and tissue engineering?
- How do photoresists work and why do some polymers contract when exposed to light?
- What are high-performance polymers and why do they have such a wide application range, e.g., in implants?
- What polymers fuel the household 3D printing community and what materials do 3D printers such as, e.g., the RepRap work with?
- How does 3D printing and rapid prototyping work and which polymers can be employed for which techniques?
- Why does silicone always smell like vinegar and why is this material so important for modern day microfluidics? How do you built fluid-logic devices using silicone?
- How do shape memory polymers remember their shape?
- What are polymer foams and why are they not only important for heat insulation but also for organic chemistry?
- How do glues work? Why are there two-component glues, what is superglue and how can you make glue from potatoes?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu). Preregistration is not necessary.

The examination will be held in oral form at the end of the lecture. The lecture can be chosen as "Nebenfach" or part of a "Hauptfach". The second lecture of the lecture series "Polymers in MEMS B – Physics, manufacturing and applications" (which is also held in winter semester) can be combined with this lecture as part of a "Hauptfach". In summer semester, the third part of the lecture series "Polymers in MEMS C – Biopolymers, Biopolymers and applications" will be given which may be combined with lectures A and B to form a complete "Hauptfach".

**Annotation**

For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu). Preregistration is not necessary.

**Workload**

- lecture: 15 * 1.5 h (22 h)
- lecture preparation (before and after lecture): 15 * 2 h (30 h)
- preparation of final exam: 70 h

# T 3.309 Course: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2141854 | Polymers in MEMS B: Physics, Microstructuring and Applications | 2 SWS | Lecture (V) | Worgull |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102191 | Polymers in MEMS B: Physics, Microstructuring and Applications | | Prüfung (PR) | Worgull |
| WS 18/19 | 76-T-MACH-102191 | Polymers in MEMS B: Physics, Microstructuring and Applications | | Prüfung (PR) | Worgull |

**Competence Certificate**
Oral examination

**Prerequisites**
none

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

## V Polymers in MEMS B: Physics, Microstructuring and Applications

2141854, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
The lecture slides will be given out as scriptum during each lecture course.

**Learning Content**

We all come in contact with numerous polymeric products in everyday life. From water bottles to packaging to the cover of the iPad, many things are made of polymers. Polymers are also important materials for modern microelectromechanical systems (MEMS) allowing cost effective mass market compatible products, e.g., in the life sciences or diagnostics. But polymers are not just cost-effective replacements for more expensive classical materials in MEMS (such as, e.g., silicon) – some polymers have intrinsic properties that make them ideal materials for sensors, actuators or templates for biology and chemistry in MEMS.
This lecture will introduce the basics of physics and material science required for the understanding of the mechanical behavior seen from the engineers view. Micro and nanostructuring of polymers allows the fabrication of micro parts fulfilling their tasks in mostly invisible different applications. But also the fabrication of polymer parts with functional surfaces inspired from Bionics will be presented in this lesson. The lesson will give further an overview over the polymer based structuring processes and will underline the importance by a number of applications e.g. photonic structures or Lotus-like structures.

Some of the topics covered are:

- How can polymers described from the view of engineers?
- What are the differences between polymers and metals?
- Rheology of polymer melts – How does polymer melts flow?
- How can polymers be formed and demolded?
- Which structuring processes (replication) processes are available?
- How does stress influence molded parts (e.g. the deformation of a CD in a hot car)
- Shrinkage of polymers – which precision is achievable
- Gluing or welding – How can polymers be assembled?
- Simulation of replication processes
- Characterization of polymers – which properties can be measured?

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.

The examination will be held in oral form at the end of the lecture. The lecture can be chosen as "Nebenfach" or part of a "Hauptfach". The second lecture of the lecture series ""Polymers in MEMS A – Chemistry, synthesis and applications " (which is also held in winter semester) can be combined with this lecture as part of a "Hauptfach". In summer semester, the third part of the lecture series "Polymers in MEMS C – Biopolymers, Biopolymers and applications" will be given which may be combined with lectures A and B to form a complete "Hauptfach".

**Annotation**

For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

**Workload**

- lecture: 15 * 1.5 h (22 h)
- lecture preparation (before and after lecture): 15 * 2 h (30 h)
- preparation of final exam: 70 h

## T 3.310 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142855 | Polymers in MEMS C - Biopolymers and Bioplastics | 2 SWS | Lecture (V) | Worgull, Rapp |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102200 | Polymers in MEMS C: Biopolymers and Bioplastics | | Prüfung (PR) | Worgull, Rapp |
| WS 18/19 | 76-T-MACH-102200 | Polymers in MEMS C: Biopolymers and Bioplastics | | Prüfung (PR) | Worgull, Rapp |

**Competence Certificate**
Oral examination

**Prerequisites**
none

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

### V Polymers in MEMS C - Biopolymers and Bioplastics

**Lecture (V)**

2142855, SS 2018, 2 SWS, Open in study portal

**Learning Content**
Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.

This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.

Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are "natural glues" and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

**Annotation**
For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

**Workload**

- lecture: 15 * 1.5 h (22 h)
- lecture preparation (before and after lecture): 15 * 2 h (30 h)

preparation of final exam: 70 h

**Literature**
Additional literature is not required.

## T 3.311 Course: Powertrain Systems Technology A: Automotive Systems [T-MACH-105233]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Sascha Ott

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146180 | Powertrain Systems Technology A: Automotive Systems | 2 SWS | Lecture (V) | Albers, Ott |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105233 | Powertrain Systems Technology A: Automotive Systems | | Prüfung (PR) | Albers |

**Competence Certificate**
written examination: 60 min duration

**Prerequisites**
None

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

### V Powertrain Systems Technology A: Automotive Systems

2146180, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Powertrain System

Driver System

Environment System

System Components

Development Process

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**
Kirchner, E.; "Leistungsübertragung in Fahrzeuggetrieben: Grundlagen der Auslegung, Entwicklung und Validierung von Fahrzeuggetrieben und deren Komponenten", Springer Verlag Berlin Heidelberg 2007

Naunheimer, H.; "Fahrzeuggetriebe: Grundlagen, Auswahl, Auslegung und Konstruktion", Springer Verlag Berlin Heidelberg 2007

## T 3.312 Course: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Sascha Ott

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2145150 | Powertrain Systems Technology B: Stationary Machinery | 2 SWS | Lecture (V) | Albers, Ott |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | | Prüfung (PR) | Albers |

**Competence Certificate**
written examination: 60 min duration

**Prerequisites**
None

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

### V Powertrain Systems Technology B: Stationary Machinery
2145150, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Powertrain System

Operator System

Environment System

System Components

Development Process

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**
VDI-2241: "Schaltare fremdbetätigte Reibkupplungen und -bremsen", VDI Verlag GmbH, Düsseldorf

Geilker, U.: "Industriekupplungen - Funktion, Auslegung, Anwendung", Die Bibliothek der Technik, Band 178, verlag moderne industrie, 1999

# T 3.313 Course: Practical Course “Tribology” [T-MACH-105813]

**Responsible:** Prof. Dr. Martin Dienwiebel
Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2182115 | Praktikum "Tribologie" | 3 SWS | Practical course (P) | Schneider, Dienwiebel |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105813 | Praktikum "Tribologie" | | Prüfung (PR) | Schneider, Dienwiebel |
| WS 18/19 | 76-T-MACH-105813 | Praktikum "Tribologie" | | Prüfung (PR) | Schneider, Dienwiebel |

### 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
The attendance to one of the course Tribology (2181114) is strongly recommended!

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

## V Praktikum "Tribologie"
2182115, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

### Learning Content
The laboratory compromises five full-day experiments, which address the following topics:

- tribological system analysis
- basics of tribological measurement techniques
- topographical surface characterization
- tribological model tests under sliding, rolling and abrasive conditions
- microscopical characterization of worn surfaces

### Annotation
The maximum number of students is 12.

### Workload
regular attendance: 35 hours

self-study: 85 hours

### Literature
H. Czichos, K.-H. Habig: Tribologie-Handbuch. Vieweg + Teubner Verlag, Wiesbaden, 2010 (http://www.springerlink.com/content/nl4kn1/?MUD=MP)

K. Sommer, R. Heinz, J. Schöfer: Verschleiß metallischer Werkstoffe: Erscheinungsformen sicher beurteilen. Vieweg + Teubner Verlag, Wiesbaden, 2010 (http://www.springerlink.com/content/u24843/#section=806215&page=1)

Gesellschaft für Tribologie e.V. (GFT): Arbeitsblatt 7: Tribologie – Verschleiß, Reibung: Definitionen, Begriffe, Prüfung. GFT, Moers, 2002. (Download unterwww.gft-ev.de/arbeitsblaetter.htm)

K.-H. Zum Gahr: Microstructure and wear of materials. Elsevier, Amsterdam, 1987.

# T 3.314 Course: Practical Course Polymers in MEMS [T-MACH-105556]

**Responsible:** Dr.-Ing. Bastian Rapp
Dr.Ing. Matthias Worgull

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 2 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2142856 | Practical Course Polymers in MEMS | 2 SWS | Block (B) | Worgull, Rapp |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105556 | Practical Course Polymers in MEMS | | Prüfung (PR) | Worgull, Rapp |
| WS 18/19 | 76-T-MACH-105556 | Practical Course Polymers in MEMS | | Prüfung (PR) | Worgull, Rapp |

**Competence Certificate**
The practical course will close with an oral examination.There will be only passed and failed results, no grades.

**Prerequisites**
none

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

## V Practical Course Polymers in MEMS

2142856, SS 2018, 2 SWS, Open in study portal

**Block (B)**

**Description**
**Media:**
descriptions of the experiments

**Learning Content**
This practical course complements the lectures "Polymers in MEMS A", "Polymers in MEMS B" and "Polymers in MEMS C" and will allow students to gain a deeper understanding of polymers and their processing. During the course of this practical course, various polymers will be synthesized and molded into components suitable for microelectromechanical systems (MEMS) applications. The aim of the course is to bring a polymer all the way from synthesis to application.
The practical course will be given in German language unless non-German speaking students attend. In this case, the course will be given in English (with some German translations of technical vocabulary). Lecture notes for the experiments are in English language and will be handed out to the students. The practical course will be held "en block" at the end of the semester (presumably beginning of October)

For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is mandatory. The number of participants is limited to 5 students.

**Workload**

- practical course: 3 * 8 h (24 h)
- experiment preparation (before and after lecture): 30 h

preparation of final exam: 66 h

**Literature**
Scripts of the corresponding lectures, further literature as named there.

# T 3.315 Course: Practical Course Technical Ceramics [T-MACH-105178]

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

**Part of:** M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 1 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2125751 | Practical Course Technical Ceramics | 2 SWS | Practical course (P) | Schell |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105178 | Practical Course Technical Ceramics | | Prüfung (PR) | Oberacker |
| WS 18/19 | 76-T-MACH-105178 | Practical Course Technical Ceramics | | Prüfung (PR) | Schell |

**Competence Certificate**
Colloquium and laboratory report for the respective experiments.

**Prerequisites**
none

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

## V Practical Course Technical Ceramics

2125751, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
Based on alumina as a model material, major test methods for the characterization of raw materials, intermediate and final products are practically applied. Topics:

- powder caracterization
- Shaping of powder compacts
- sintering
- microstructural characterization
- mechanical testing

On the basis of short descriptions of the methods, the students prepare themselfes, carry out the experiments and write a laboratory report.

**Workload**
regular attendance: 30 hours
self-study: 90 hours

**Literature**
Salmang, H.: Keramik, 7. Aufl., Springer Berlin Heidelberg, 2007. - Online-Ressource

Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006

## T 3.316 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-102615 - Schwerpunkt: Medizintechnik
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2143875 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| SS 2018 | 2143877 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| WS 18/19 | 2143875 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| WS 18/19 | 2143877 | Introduction to Microsystem Technology - Practical Course | 2 SWS | Practical course (P) | Last |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102164 | Practical Training in Basics of Microsystem Technology | | Prüfung (PR) | Last |
| WS 18/19 | 76-T-MACH-102164 | Practical Training in Basics of Microsystem Technology | | Prüfung (PR) | Last |

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

**Prerequisites**
none

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

### V Introduction to Microsystem Technology - Practical Course

2143875, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

## V Introduction to Microsystem Technology - Practical Course

2143877, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

## V Introduction to Microsystem Technology - Practical Course

2143875, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

## V Introduction to Microsystem Technology - Practical Course

2143877, WS 18/19, 2 SWS, Open in study portal

**Practical course (P)**

**Learning 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.

**Workload**
Time of attendance: 21 h + 2 h exam
Privat studies: 5 h preparing experiments + 10 h preparing the exam

## T 3.317 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-102591 - Laborpraktikum
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162208 | Schwingungstechnisches Praktikum | SWS | Practical course (P) | Fidlin, Burgert |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105373 | Practical Training in Measurement of Vibrations | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105373 | Practical Training in Measurement of Vibrations | | Prüfung (PR) | Fidlin |

**Competence Certificate**
Colloquium to each session, 10 out of 10 colloquiums must be passed

**Prerequisites**
Can not be combined with Experimental Dynamics (T-MACH-105514).

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105514 - Experimental Dynamics must not have been started.

**Recommendation**
Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations

# T 3.318 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2193010 | Basic principles of powder metallurgical and ceramic processing | 2 SWS | Lecture (V) | Schell |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | | Prüfung (PR) | Schell |
| WS 18/19 | 76-T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | | Prüfung (PR) | Schell |

**Competence Certificate**
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

**Prerequisites**
none

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

## V Basic principles of powder metallurgical and ceramic processing

2193010, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The course covers fundamentals of the process technology for shaping of ceramic or metal particle systems. Important shaping methods are reviewed. The focus is on characterization and properties of particulate systems, and, in particular, on process technology for shaping of powders, pastes, and suspensions.

**Workload**
regular attendance: 25 hours
self-study: 95 hours

**Literature**

- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Cermamic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

## T 3.319 Course: Principles of Medicine for Engineers [T-MACH-105235]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2105992 | Principles of Medicine for Engineers | 2 SWS | Lecture (V) | Pylatiuk |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105235 | Principles of Medicine for Engineers | | Prüfung (PR) | Hagenmeyer, Pylatiuk |
| WS 18/19 | 76-T-MACH-105235 | Principles of Medicine for Engineers | | Prüfung (PR) | Pylatiuk |

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

**Prerequisites**
none

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

### V Principles of Medicine for Engineers
2105992, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Annotation**
**Recommendations:** Organ support systems

**Workload**
General attendance: 21 h

Self-study: 99 h

**Literature**

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

# T 3.320 Course: Probability Theory and Statistics [T-MATH-109620]

**Responsible:** Prof. Dr. Daniel Hug
**Organisation:** KIT Department of Mathematics
**Part of:** M-MACH-102594 - Mathematische Methoden
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each term | 2 |

**Competence Certificate**
Written exam (90 min.)

**Prerequisites**
None

# T 3.321 Course: Process Simulation in Forming Operations [T-MACH-105348]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161501 | Process Simulation in Forming Operations | 2 SWS | Lecture (V) | Helm |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105348 | Process Simulation in Forming Operations | | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | 76-T-MACH-105348 | Process Simulation in Forming Operations | | Prüfung (PR) | |

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

**Prerequisites**
none

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

## V Process Simulation in Forming Operations

2161501, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Based on basics of continuum mechanics, material theory and numerics the lecture gives an introduction into the simulation of forming operations for metals

- plasticity for metallic materials: dislocations, twinning, phase transformations, aniostropy, hardening
- classification of forming operations and discussion of selected topics
- basics of tensor algebra and tensor analysis
- continuum mechanics: kinematics, finite deformations, balance laws, thermdydnamics
- material theory: basics, modelling concepts, plasticity and visco plasticity, yield functions (von Mises, Hill, ...), kinematic and isotropic hardening, damage
- thermomechanical coupling
- modelling of contact
- finite element method: explicit and implicite formulations, types of elements, numerical integration of material models
- process simulation of selected problems of sheet metal forming

## T 3.322 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-102593 - Produktentstehung - Bauteildimensionierung

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 7 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2150511 | Produktentstehung - Bauteildimensionierung | SWS | Lecture / Practice (VÜ) | Schulze, Dietrich |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105383 | Product Development - Dimensioning of Components | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-105383 | Product Development - Dimensioning of Components | | Prüfung (PR) | Schulze |

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

**Prerequisites**
none

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

### V Produktentstehung - Bauteildimensionierung

2150511, SS 2018, SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning 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.

**Literature**
Lecture notes

## T 3.323 Course: Product Lifecycle Management [T-MACH-105147]

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

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2121350 | Product Lifecycle Management | 2 SWS | Lecture (V) | Ovtcharova |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105147 | Product Lifecycle Management | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-105147 | Product Lifecycle Management | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Writen examination 90 min.

**Prerequisites**
None

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

### V Product Lifecycle Management

2121350, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Product Lifecycle Management (PLM) is an approach to the holistic and cross-company management and control of all product-related processes and data throughout the life cycle along the extended supply chain - from design and production to sales, to the dismantling and recycling.

Product Lifecycle Management is a comprehensive approach for effective and efficient design of the product life cycle. Based on all product information, which comes up across the entire value chain and across multiple partners, processes, methods and tools are made available to provide the right information at the right time, quality and the right place.

The course covers:

- A consistent description of all business processes that occur during the product life cycle (development, production, sales, dismantling, ...)
- the presentation of methods for the performance of the PLM business processes,
- explaining the most important corporate information systems to support the life cycle (PDM, ERP, SCM, CRM systems) to sample the software manufacturer SAP

**Workload**
regular attendance: 42 hours
self-study: 128 hours

**Literature**
Lecture slides.

V. Arnold et al: Product Lifecycle Management beherrschen, Springer-Verlag, Heidelberg, 2005.

J. Stark: Product Lifecycle Management, 21st Century Paradigm for Product Realisation, Springer-Verlag, London, 2006.

A. W. Scheer et al: Prozessorientiertes Product Lifecycle Management, Springer-Verlag, Berlin, 2006.

J. Schöttner: Produktdatenmanagement in der Fertigungsindustrie, Hanser-Verlag, München, 1999.

M.Eigner, R. Stelzer: Produktdaten Management-Systeme, Springer-Verlag, Berlin, 2001.

G. Hartmann: Product Lifecycle Management with SAP, Galileo press, 2007.

K. Obermann: CAD/CAM/PLM-Handbuch, 2004.

# T 3.324 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123364 | Product, Process and Resource Integration in the Automotive Industry | 2 SWS | Lecture (V) | Mbang |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102155 | Product, Process and Resource Integration in the Automotive Industry | | Prüfung (PR) | Mbang |
| WS 18/19 | 76-T-MACH-102155 | Product, Process and Resource Integration in the Automotive Industry | | Prüfung (PR) | Mbang |

**Competence Certificate**
Oral examination 20 min.

**Prerequisites**
None

**Annotation**
Limited number of participants.

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

## V Product, Process and Resource Integration in the Automotive Industry

2123364, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The lecture

- 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)
- Systems: Siemens NX .

Additionally, A practical industrial project study is offered, which is based on an integrated application scenario (from design of production resources, over testing and validation method planning to the manufacturing and implementation of the production resources).

Since the student will be divided in small teams, this study will also teach the students about team word and distributed development.

**Annotation**
Max. 20 students, registration necessary (ILIAS)

**Workload**
regular attendance: 32 hours
self-study: 72 hours

**Literature**
Lecture slides

# T 3.325 Course: Production and Logistics Controlling [T-WIWI-103091]

**Responsible:** Alexander Rausch
**Organisation:** KIT Department of Economics and Management
**Part of:** M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2500005 | Produktions- und Logistikcontrolling | 2 SWS | Lecture (V) | Rausch |
| **Exams** | | | | | |
| SS 2018 | 79-T-WIWI-103091 | Production and Logistics Controlling | | Prüfung (PR) | Furmans, Mittwollen |
| WS 18/19 | 79-T-WIWI-103091 | Production and Logistics Controlling | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment consists of a written exam (60 minutes) following §4(2), 1 of the examination regulation.
The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**
None

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

## V Produktions- und Logistikcontrolling

2500005, WS 18/19, 2 SWS, Open in study portal **Lecture (V)**

**Learning Content**
1. Overview of Controlling
2. Performance Measurement
3. Planning
4. Reporting
5. Deviation Analysis

## T 3.326 Course: Production Planning and Control [T-MACH-105470]

**Responsible:** Dr.-Ing. Andreas Rinn
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2110032 | Production Planning and Control | 2 SWS | Block lecture (BV) | Rinn |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105470 | Production Planning and Control | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105470 | Production Planning and Control | | Prüfung (PR) | Deml |

**Competence Certificate**
written exam 60 minutes (if the number of participants is low, the examination is oral, 20 minutes)

**Prerequisites**
Timely pre-registration in ILIAS, since participation is limited.

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

### V Production Planning and Control
2110032, WS 18/19, 2 SWS, Open in study portal

**Block lecture (BV)**

**Learning Content**

1. Goals and recommanditions for production planning and control
2. Strategies for work control
3. Case study: Manufacturing of bicycles
4. FASI-Plus: Simulation of a bicycle factory for the production planning and control
5. Simulation of the order processing
6. Decision making about order control and procurement of purchased parts
7. Evaluation of the simulation protocols
8. Realisation of production planning and control

**Workload**
Compact course.

The amount of work accounts for 120 h (=4 ECTS).

**Literature**
Handout and literature are available on ILIAS for download.

## T 3.327 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-102591 - Laborpraktikum
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110678 | Production Techniques Laboratory | 3 SWS | Practical course (P) | Deml, Fleischer, Furmans, Ovtcharova |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105346 | Production Techniques Laboratory | | Prüfung (PR) | Deml, Furmans, Ovtcharova, Schulze |
| WS 18/19 | 76-T-MACH-105346 | Production Techniques Laboratory | | Prüfung (PR) | Deml, Furmans, Ovtcharova, Schulze |

### Competence Certificate
**Advanced Internship:** Participate in practicle exercise courses and complete the colloquia successfully.

**Elective Subject:** Participate in practicle exercise courses and complete the colloquia successfully and presentation of a specific topic.

### Prerequisites
None

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

## V Production Techniques Laboratory

2110678, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

### Description
**Media:**

several

### Learning 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)

**Annotation**
none

**Workload**
**Advanced Internship:** The amount of work is 90 h (=3 ECTS).

**Elective Subject:** The amount of work is 120 h (=4 ECTS).

**Optional Subject:** The amount of work is 120 h (=4 ECTS).

**Literature**
Handouts and literature references are available online on ILIAS.

## T 3.328 Course: Productivity Management in Production Systems [T-MACH-105523]

**Responsible:** Prof. Dr. Sascha Stowasser
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110046 | Productivity Management in Production Systems | 4 SWS | Block lecture (BV) | Stowasser |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105523 | Productivity Management in Production Systems | | Prüfung (PR) | Deml |
| WS 18/19 | 76-T-MACH-105523 | Productivity Management in Production Systems | | Prüfung (PR) | Deml |

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

The exam is offered in German only!

### Prerequisites
none

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

## V Productivity Management in Production Systems
2110046, SS 2018, 4 SWS, Open in study portal

**Block lecture (BV)**

### Description
**Media:**
Powerpoint, movies, exercises

### Learning Content

1. Definition and terminology of process design and industrial engineering
2. Tasks of industrial engineering
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)
4. Methods and principles of industrial engineering and production systems
5. Case studies and exercises for process design
6. Industry 4.0

### Workload
Compact course (one week full-time).

The amount of work accounts for 120 h (=4 ECTS).

### Literature
Handout and literature is available on ILIAS for download.

## T 3.329 Course: Project Management in Global Product Engineering Structures [T-MACH-105347]

**Responsible:** Dr.-Ing. Peter Gutzmer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2145182 | Project management in Global Product Engineering Structures | 2 SWS | Lecture (V) | Gutzmer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105347 | Project Management in Global Product Engineering Structures | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105347 | Project Management in Global Product Engineering Structures | | Prüfung (PR) | Albers |

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

Aids: None

**Prerequisites**
none

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

### V Project management in Global Product Engineering Structures — Lecture (V)
2145182, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
Product development process

Coordination of product development and handling of complexity

project management

matrix organization

planning / specification / target system

interaction of development and production

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**
lecture notes

## T 3.330 Course: Project Management in Rail Industry [T-MACH-104599]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2115995 | Project Management in Rail Industry | 2 SWS | Lecture (V) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-104599 | Project Management in Rail Industry | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-104599 | Project Management in Rail Industry | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Oral examination

Duration: 20 minutes

No tools or reference materials may be used during the exam.

**Prerequisites**
none

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

### V Project Management in Rail Industry
2115995, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

All slides are available for download (Ilias-platform).

**Notes**
The lecture will be held for the last time in the winter term 2019. Exams can be taken until the end of the examination period of the winter term 2020.

**Learning Content**
Rail vehicles are capital-intensive goods which are manufactured in small series (like aircraft). The work to done at industry and customers is organized in "projects". This is completely different to the way of working in large-scale production (like car industry). Everybody working in this type of business is part of a project and should be aware of the typical processes.

The lecturer provides a comprehensive overview about modern project management for small series of capital-intensive goods. The content is valid not for rail vehicle business but also for other areas with similar business processes.
The following topics will be discussed:

1. Introduction: definition of project and project management
2. Project management system: project phases, main processes and supporting processes, governance
3. Organization: organizational structure within a company, project organization, roles in a project organization
4. Main processes: project start, project plan, work brake down structure, detailed project schedule, risk and opportunity management, change management, project closure
5. Governance

**Annotation**
None.

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
A bibliography is available for download (Ilias-platform).

# T 3.331 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149680 | Project Micro-Manufacturing: Design and Manufacturing of a Microsystem | 3 SWS | Project group (Pg) | Schulze, Kacaras |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-105457 | Project Mikromanufacturing: Development and Manufacturing of Microsystems | | Prüfung (PR) | Schulze |

**Competence Certificate**
Alternative test achievement (graded):

- presentation (about 15 min) with weighting 40%
- scientific colloquium (about 15 min) with weighting 40%
- Project work (graded) with weighting 20%

**Prerequisites**
None

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

## V Project Micro-Manufacturing: Design and Manufacturing of a Microsystem

**Project group (Pg)**

2149680, WS 18/19, 3 SWS, Open in study portal

**Description**
**Media:**

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

**Learning 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.

**Workload**
regluar attendance: 31,5 hours
self-study: 148,5 hours

## T 3.332 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2115817 | Project Workshop: Automotive Engineering | 3 SWS | Lecture (V) | Gauterin, Gießler, Frey |
| WS 18/19 | 2115817 | Project Workshop: Automotive Engineering | 3 SWS | Lecture (V) | Gauterin, Gießler, Frey |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102156 | Project Workshop: Automotive Engineering | | Prüfung (PR) | Gauterin |
| WS 18/19 | 76-T-MACH-102156 | Project Workshop: Automotive Engineering | | Prüfung (PR) | Gauterin |

**Competence Certificate**
Oral examination

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
none

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

### V Project Workshop: Automotive Engineering

2115817, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Annotation**
Selection procedure, applications are to submit in the end of the preceding semester.

**Workload**
regular attendance: 49 hours
self-study:131 hours

**Literature**
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

The scripts will be supplied in the start-up meeting.

V **Project Workshop: Automotive Engineering** **Lecture (V)**
2115817, WS 18/19, 3 SWS, Open in study portal

**Notes**
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.

**Learning 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.

**Annotation**
Selection procedure, applications are to submit in the end of the preceding semester.

**Workload**
regular attendance: 49 hours
self-study: 131 hours

**Literature**
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

The scripts will be supplied in the start-up meeting.

## T 3.333 Course: ProVIL - Product development in a Virtual Idea Laboratory [T-MACH-106738]

**Responsible:** Prof. Dr.-Ing. Albert Albers
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146210 | ProVIL – Produktentwicklung im virtuellen Ideenlabor | SWS | Lecture (V) | Matthiesen |

**Competence Certificate**
colloquia and presentations.

**Prerequisites**
none

## T 3.334 Course: Public Law I - Basic Principles [T-INFO-101963]

**Responsible:** Prof. Dr. Nikolaus Marsch
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each term | 2 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 24016 | Öffentliches Recht I - Grundlagen | 2 SWS | Lecture (V) | Marsch |
| **Exams** | | | | | |
| SS 2018 | 7500100 | Public Law I - Basic Principles | | Prüfung (PR) | Marsch |
| WS 18/19 | 7500051 | Public Law I - Basic Principles | | Prüfung (PR) | Marsch |

## T 3.335 Course: Quality Management [T-MACH-102107]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102596 - Wahlpflichtmodul Wirtschaft/Recht
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102640 - Schwerpunkt: Technische Logistik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2149667 | Quality Management | 2 SWS | Lecture (V) | Lanza |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102107 | Quality Management | | Prüfung (PR) | Lanza |
| WS 18/19 | 76-T-MACH-102107 | Quality Management | | Prüfung (PR) | Lanza |

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

**Prerequisites**
none

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

### V Quality Management
2149667, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

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

**Learning 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-specic elds 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 servicerelated quality management. The content is completed with the presentation of certication possibilities and legal quality aspects.
Main topics of the lecture:

- The term "quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

**Annotation**
None

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

## T 3.336 Course: Radiation Protection: Ionising Radiation [T-ETIT-100663]

**Responsible:** Prof. Dr. Olaf Dössel
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 3 | Each winter term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 7305271 | Radiation Protection: Ionising Radiation | Prüfung (PR) | Urban |

**Prerequisites**
none

## T 3.337 Course: Rail System Technology [T-MACH-106424]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2115919 | Rail System Technology | 2 SWS | Lecture (V) | Gratzfeld |
| WS 18/19 | 2115919 | Rail System Technology | 2 SWS | Lecture (V) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106424 | Rail System Technology | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-106424 | Rail System Technology | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Oral examination

Duration: 20 minutes

No tools or reference materials may be used during the exam.

**Prerequisites**
none

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

### V Rail System Technology
2115919, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

All slides are available for download (Ilias-platform).

**Learning 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. Signalling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
A bibliography is available for download (Ilias-platform).

## V Rail System Technology

2115919, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

All slides are available for download (Ilias-platform).

**Learning 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. Signalling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
A bibliography is available for download (Ilias-platform).

## T 3.338 Course: Rail Vehicle Technology [T-MACH-105353]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2115996 | Rail Vehicle Technology | 2 SWS | Lecture (V) | Gratzfeld |
| WS 18/19 | 2115996 | Rail Vehicle Technology | 2 SWS | Lecture (V) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105353 | Rail Vehicle Technology | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-105353 | Rail Vehicle Technology | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Oral examination

Duration: 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 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

All slides are available for download (Ilias-platform).

**Learning Content**
Vehicle system technology: structure and main systems of rail vehicles

Drives: Electric and non-electric traction drives

Brakes: Tasks, basics, principles, brake control

Bogies: forces, running gears, axle configuration

Vehicle concepts: trams, metros, regional trains, double deck coaches, locomotives

Examples of existing rail vehicles were discussed.

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
A bibliography is available for download (Ilias-platform).

V

## Rail Vehicle Technology

2115996, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. System structure of rail vehicles: tasks and classification of rail vehicles, main systems, vehicle system technology
2. Drives: Electric and non-electric traction drives
3. Brakes: Tasks, basics, principles, brake control
4. Bogies: forces, running gears, axle configuration
5. Vehicle concepts: trams, metros, regional trains, high speed trains, double deck coaches, locomotives. Examples of existing rail vehicles were discussed.

**Workload**

Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**

A bibliography is available for download (Ilias-platform).

## T 3.339 Course: Railways in the Transportation Market [T-MACH-105540]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114914 | Railways in the Transportation Market | 2 SWS | Block lecture (BV) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105540 | Railways in the Transportation Market | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-105540 | Railways in the Transportation Market | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Oral examination

Duration: 20 minutes

No tools or reference materials may be used during the exam.

**Prerequisites**
none

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

### V Railways in the Transportation Market

2114914, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Description**
**Media:**

All material is available for download (Ilias-platform).

**Learning 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
- Overview of Deutsche Bahn
- Development of infrastructure
- Regulation of railways
- Intra- and intermodal competition
- Field of actions in transport policy
- Railways and enviroment
- Trends in the transportation market
- Future of Deutsche Bahn, DB 2020
- Integration of traffic carriers
- International passenger and freight transportation

**Workload**
Regular attendance: 21 hours

Self-study: 21 hours

Exam and preparation: 78 hours

**Literature**
none

## T 3.340 Course: Reactor Safety I: Fundamentals [T-MACH-105405]

**Responsible:** Dr. Victor Hugo Sanchez-Espinoza
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2189465 | Reactor Safety I: Fundamentals | 2 SWS | Lecture (V) | Sanchez-Espinoza |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105405 | Reactor Safety I: Fundamentals | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105405 | Reactor Safety I: Fundamentals | | Prüfung (PR) | |

**Competence Certificate**
oral exam about 30 minutes

**Prerequisites**
none

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

### V Reactor Safety I: Fundamentals
2189465, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
In the lecture, the fundamental principles and concepts of reactor safety explained. 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 presented in this lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

**Lecture Content:**

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents e.g. the Fukushima accident
- Safety features of reactor systems of generation 3 and 4

**Workload**
regular attendance: 30 h
self-study: 60 h

**Literature**


- G. Kessler at al; Risks of Nuclear Energy Technology- Safety Concepts of Light Water Reactors. Springer Verlag 2014.
- B. R. Sehgal; Nuclear Safety in LWR: Severe Accident Phenomenology. Academic Press Elsevier. 2012.
- John C. Lee and Norman J. McCormick.July; Risk and Safety Analysis of Nuclear Systems. 2011
- G. Petrangeli; Nuclear Safety. Elsevier Butterworth-Heinemann. 2006
- J. N. Lillington; Light Water Reactor Safety: The Development of Advanced Models and Codes for Light Water Reactor Safety Analysis. Elsevier 1995.

## T 3.341 Course: Reduction Methods for the Modeling and the Simulation of Vombustion Processes [T-MACH-105421]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2166543 | Reduction methods for the modeling and the simulation of combustion processes | 2 SWS | Lecture (V) | Bykov |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105421 | Reduction Methods for the Modeling and the Simulation of Vombustion Processes | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105421 | Reduction Methods for the Modeling and the Simulation of Vombustion Processes | | Prüfung (PR) | Maas |

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

**Prerequisites**
none

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

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

**Lecture (V)**

2166543, SS 2018, 2 SWS, Open in study portal

**Learning 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.

**Workload**
regular attendance: 21 hours

self-study: 100,0 hours

**Literature**
N. Peters, B. Rogg: Reduced kinetic mechanisms for aplication in combustion systems, Lecture notes in physics, 15, Springer Verlag, 1993.

## T 3.342 Course: Reliability Engineering 1 [T-MACH-107447]

**Responsible:** Dr.-Ing. Alexei Konnov
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102624 - Schwerpunkt: Informationstechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2169550 | Reliability Engineering 1 | 2 SWS | Lecture (V) | Konnov |
| WS 18/19 | 2169550 | Reliability Engineering 1 | 2 SWS | Lecture (V) | Konnov |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-107447 | Reliability Engineering 1 | | Prüfung (PR) | |

**Competence Certificate**
written exam

**Prerequisites**
none

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

### V Reliability Engineering 1
2169550, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Technical background: instrumentation and control systems in power plants

Introduction to reliability theory
Introduction to probability theory
Introduction to formal logic
Introduction to statistic

**Workload**
regular attandance: 25 h

self-study: 65 h

**Literature**
Lesson script (link will be available)

Recommended books:

o Birolini, Alessandro: *Reliability Engineering Theory and Practice*

o Pham, Hoang: *Handbook of reliability engineering*

### V Reliability Engineering 1
2169550, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Technical background: instrumentation and control systems in power plants

Introduction to reliability theory
Introduction to probability theory
Introduction to formal logic
Introduction to statistic

**Workload**

regular attandance: 25 h

self-study: 65 h

**Literature**

Lesson script (link will be available)

Recommended books:

o Birolini, Alessandro: *Reliability Engineering Theory and Practice*

o Pham, Hoang: *Handbook of reliability engineering*

# T 3.343 Course: Renewable Energy-Resources, Technologies and Economics [T-WIWI-100806]

**Responsible:** PD Dr. Patrick Jochem
Prof. Dr. Russell McKenna

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

**Part of:** M-MACH-104323 - Schwerpunkt: Innovation und Entrepreneurship

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3,5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2581012 | Renewable Energy – Resources, Technologies and Economics | 2 SWS | Lecture (V) | McKenna, Jochem |
| **Exams** | | | | | |
| SS 2018 | 7981012 | Renewable Energy-Resources, Technologies and Economics | | Prüfung (PR) | Fichtner |
| WS 18/19 | 7981012 | Renewable Energy-Resources, Technologies and Economics | | Prüfung (PR) | Fichtner |

**Competence Certificate**
The assessment consists of a written exam (60 min., in English, answers in English or German) according to § 4 paragraph 2 Nr. 1 of the examination regulation SPO2015.

**Prerequisites**
None.

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

## V Renewable Energy – Resources, Technologies and Economics

2581012, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
The total workload for this course is approximately 105.0 hours. For further information see German version.

**Literature**
**Elective literature:**


- Kaltschmitt, M., 2006, Erneuerbare Energien : Systemtechnik, Wirtschaftlichkeit, Umweltaspekte, aktualisierte, korrigierte und ergänzte Auflage Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg.
- Kaltschmitt, M., Streicher, W., Wiese, A. (eds.), 2007, Renewable Energy: Technology, Economics and Environment, Springer, Heidelberg.
- Quaschning, V., 2010, Erneuerbare Energien und Klimaschutz : Hintergründe - Techniken - Anlagenplanung – Wirtschaftlichkeit München : Hanser, Ill.2., aktualis. Aufl.
- Harvey, D., 2010, Energy and the New Reality 2: Carbon-Free Energy Supply, Eathscan, London/Washington.
- Boyle, G. (ed.), 2004, Renewable Energy: Power for a Sustainable Future, 2nd Edition, Open University Press, Oxford.

## T 3.344 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each winter term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2424152 | Robotics I - Introduction to Robotics | 3/1 SWS | Lecture (V) | Asfour, Kaiser, Paus, Beil |
| **Exams** | | | | | |
| SS 2018 | 7500218 | Robotik I - Einführung in die Robotik | | Prüfung (PR) | Asfour |
| WS 18/19 | 7500106 | Robotics I - Introduction to Robotics | | Prüfung (PR) | Asfour |

## T 3.345 Course: Robotics II: Humanoid Robotics [T-INFO-105723]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2400074 | Robotics II: Humanoid Robotics | 2 SWS | Lecture (V) | Asfour, Kaiser, Mandery, Ottenhaus, Wächter, Paus |
| **Exams** | | | | | |
| SS 2018 | 7500086 | Robotics II: Humanoid Robotics | | Prüfung (PR) | Asfour |
| WS 18/19 | 7500211 | Robotics II: Humanoid Robotics | | Prüfung (PR) | Asfour |

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

### V Robotics II: Humanoid Robotics

2400074, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Workload**
90 h

## T 3.346 Course: Robotics III - Sensors in Robotics [T-INFO-101352]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour
**Organisation:** KIT Department of Informatics
**Part of:** M-MACH-102609 - Schwerpunkt: Kognitive Technische Systeme
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 3 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2400067 | Robotics III - Sensors in Robotics | 2 SWS | Lecture (V) | Asfour, Grotz |
| **Exams** | | | | | |
| SS 2018 | 7500242 | Robotics III - Sensors in Robotics | | Prüfung (PR) | Asfour |
| SS 2018 | 7500265 | Robotics III - Sensors in Robotics | | Prüfung (PR) | |
| WS 18/19 | 7500207 | Robotics III - Sensors in Robotics | | Prüfung (PR) | Asfour |

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

### V Robotics III - Sensors in Robotics

2400067, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Notes**
Die Vorlesung kann im Rahmen der Vertiefungsfächer des Informatik Hauptstudiums bzw. gemäß Modulhandbuch abgeprüft werden.

Die Anmeldung zur Prüfung kann im Sekretariat Prof. Asfour Raum 029, Geb. 50.20 (Adenauerring 2) von 10.00 h bis 12.00 h oder per E-Mail sekretariat.asfour@anthropomatik.kit.edu erfolgen.

**Learning Content**
The lecture Robotics III complements the lecture Robotics I with a broad overview over sensors used in robotics and the interpretation of their data. One focus of the lecture is on the topic of computer vision, which is being dealt with from data acquisition, over calibration to object recognition and localization.

Sensors are important subcomponents of control circuits and enable robots to perform their tasks safely. Furthermore, sensors serve to capture the environment as well as dynamical processes and actions in the surroundings of the robots. The topics that are addressed in the lecture, are as follows: Sensor technology for a whole taxonomy of sensor systems (including image and 3D sensors), sensor modeling (including color calibration and hdr imaging), theory and practice of digital signal processing, machine vision, multi-sensor integration and fusion.

Among others, sensor systems such as relative position sensors (optical encoders, potentiometer), velocity sensors (encoder, tachometer), acceleration sensors (piezo-resistive, piezo-electric, optical and others), inertial sensors (gyroscope, gravitometer and others), tactile sensors (foil sensors, pressure sensitive materials and others), proximity sensors, distance sensors (ultrasonic, laser, time-of-flight, interferometry, structured light, stereo camera systems and others), image sensors (photodiode, CCD and others), absolute position sensors (GPS, fiducial markers). Laser sensors as well as image sensors are dealt with priority.

**Workload**
80h

**Literature**
The student has to understand the principles of sensors that are essential and common in robotics. The student has to understand the data flow, starting from the physical measurement, over digitization, application of the sensor model to image processing, feature extraction and the integration of the information in an environment model. The student has to be able to propose suitable sensor concepts for simple tasks and to justify them.

## T 3.347 Course: Safety Engineering [T-MACH-105171]

**Responsible:** Hans-Peter Kany
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117061 | Safety Engineering | 2 SWS | Lecture (V) | Kany |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105171 | Safety Engineering | | Prüfung (PR) | Furmans |
| WS 18/19 | 7600020 | Safety Engineering | | Prüfung (PR) | Kany |
| WS 18/19 | 76-T-MACH-105171 | Safety Engineering | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

### V Safety Engineering
2117061, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**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.

**Annotation**
none

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

**Literature**
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen, ISBN: 3-926069-06-6

# T 3.348 Course: Scaling in Fluid Dynamics [T-MACH-105400]

**Responsible:** Prof. Dr. Leo Bühler
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102634 - Schwerpunkt: Strömungsmechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2154044 | Scaling in fluid dynamics | 2 SWS | Lecture (V) | Bühler |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105400 | Scaling in Fluid Dynamics | | Prüfung (PR) | Bühler |
| WS 18/19 | 76-T-MACH-105400 | Scaling in Fluid Dynamics | | Prüfung (PR) | Bühler |

**Competence Certificate**
Oral exam

Duration: 20-30 minutes

No auxiliary means

**Prerequisites**
none

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

## V Scaling in fluid dynamics

2154044, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Annotation**
Recommendation: Fluid Mechanics

**Workload**
Regular attendance: 32 hours

self-study: 88 hours

**Literature**
G. I. Barenblatt, 1979, Similarity, Self-Similarity, and Intermediate Asymptotics, Plenum Publishing Corporation (Consultants Bureau)

J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun

G. I. Barenblatt, 1994, Scaling Phenomena in Fluid Mechanics, Cambridge University Press

## T 3.349 Course: Scientific Computing for Engineers [T-MACH-100532]

**Responsible:** Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181738 | Scientific computing for Engineers | 2 SWS | Lecture (V) | Weygand, Gumbsch |
| WS 18/19 | 2181739 | Introduction to scientific computing | 2 SWS | Practice (Ü) | Weygand |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100532 | Scientific Computing for Engineers | | Prüfung (PR) | Weygand, Gumbsch |
| WS 18/19 | 76-T-MACH-100532 | Scientific Computing for Engineers | | Prüfung (PR) | Weygand, Gumbsch |

**Competence Certificate**
Written exam (90 minutes)

**Prerequisites**
The brick can not be combined with the brick "Application of advanced programming languages in mechanical engineering" (T-MACH-105390).

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105390 - Application of Advanced Programming Languages in Mechanical Engineering must not have been started.

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

### V Scientific computing for Engineers

2181738, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. Introduction: why scientific computing
2. computer architectures
3. Introduction to Unix/Linux
4. Foundations of C++
* progamm organization
* data types, operator, control structures
* dynamic memory allocation
* functions
* class
* OpenMP parallelization
5. numeric /algorithms
* finite differences
* MD simulations: 2nd order differential equations
* algorithms for particle simulations
* solver for linear systems of eqns.

**Annotation**
The lecture can not be combined with the lecture "Application of advanced programming languages in mechanical engineering" (2182735).

**Workload**
regular attendance: 22,5 hours
Lab: 22,5 hours (optional)
self-study: 75 hours

**Literature**

1. C++: Einführung und professionelle Programmierung; U. Breymann, Hanser Verlag München
2. C++ and object-oriented numeric computing for Scientists and Engineers, Daoqui Yang, Springer Verlag.
3. The C++ Programming Language, Bjarne Stroustrup, Addison-Wesley
4. Die C++ Standardbibliothek, S. Kuhlins und M. Schader, Springer Verlag

Numerik:

1. Numerical recipes in C++ / C / Fortran (90), Cambridge University Press
2. Numerische Mathematik, H.R. Schwarz, Teubner Stuttgart
3. Numerische Simulation in der Moleküldynamik, Griebel, Knapek, Zumbusch, Caglar, Springer Verlag

V **Introduction to scientific computing** **Practice (Ü)**
2181739, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
Exercises for the different topics of the lecture "Scientific computing for Engineers" (2181738)

**Workload**
regular attendance: 22,5 hours

**Literature**
lecture notes "Scientific computing for Engineers" (2181738)

# T 3.350 Course: Selected Applications of Technical Logistics [T-MACH-102160]

**Responsible:** Viktor Milushev
Dr.-Ing. Martin Mittwollen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118087 | Selected Applications of Technical Logistics | 3 SWS | Lecture (V) | Mittwollen, Milushev |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102160 | Selected Applications of Technical Logistics | | Prüfung (PR) | Mittwollen |
| WS 18/19 | 76-T-MACH-102160 | Selected Applications of Technical Logistics | | Prüfung (PR) | Mittwollen |

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

**Recommendation**
Knowledge out of Basics of Technical Logistics (T-MACH-102163) / Elements and Systems of Technical Logistics (T-MACH-102159) preconditioned

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

## V Selected Applications of Technical Logistics

2118087, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**
supplementary sheets,projector, blackboard

**Notes**
Details according schedule will be published

**Learning Content**

- design and dimension of machines from intralogistics
- static and dynamic behaviour
- operation properties and specifics
- Inside practical lectures: sample applications and calculations in addition to the lectures

**Annotation**
Knowledge out of **Basics of Technical Logistics** preconditioned

**Workload**
presence: 36h

rework: 84h

**Literature**
Recommendations during lessons

# T 3.351 Course: Selected Applications of Technical Logistics - Project [T-MACH-108945]

**Responsible:** Viktor Milushev
Dr.-Ing. Martin Mittwollen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 2 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108945 | Selected Applications of Technical Logistics - Project | Prüfung (PR) | Mittwollen |

**Competence Certificate**
presentation of performed project and defense (30min) according to $4 (2), No. 3 of the examination regulation

**Prerequisites**
T-MACH-102160 (selected applications of technical logistics) must have been started

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-102160 - Selected Applications of Technical Logistics must have been started.

**Recommendation**
Knowledge out of Basics of Technical Logistics (T-MACH-102163) / Elements and Systems of Technical Logistics (T-MACH-102159) preconditioned

# T 3.352 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2167541 | Selected chapters of the combustion fundamentals | 2 SWS | Lecture (V) | Maas |
| WS 18/19 | 2167541 | Selected chapters of the combustion fundamentals | 2 SWS | Lecture (V) | Maas |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105428 | Selected Chapters of the Combustion Fundamentals | | Prüfung (PR) | Maas |
| WS 18/19 | 76-T-MACH-105428 | Selected Chapters of the Combustion Fundamentals | | Prüfung (PR) | Maas |

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

**Prerequisites**
none

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

## V Selected chapters of the combustion fundamentals — Lecture (V)
2167541, SS 2018, 2 SWS, Open in study portal

**Description**
**Media:**

Blackboard and Powerpoint presentation

**Learning Content**
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

**Workload**
Regular attendance: 21,5 hours
Self-study: 98,5 hours

**Literature**
Lecture notes

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, authors: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

## V Selected chapters of the combustion fundamentals — Lecture (V)
2167541, WS 18/19, 2 SWS, Open in study portal

**Description**
**Media:**

Blackboard and Powerpoint presentation

**Learning Content**
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

**Workload**
Regular attendance: 22.5 h
Self-study: 97.5 h

**Literature**
Lecture notes

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, authors: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

## T 3.353 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190411 | Selected Problems of Applied Reactor Physics and Exercises | 2 SWS | Lecture (V) | Dagan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105462 | Selected Problems of Applied Reactor Physics and Exercises | | Prüfung (PR) | Stieglitz, Dagan |
| WS 18/19 | 76-T-MACH-105462 | Selected Problems of Applied Reactor Physics and Exercises | | Prüfung (PR) | Dagan, Stieglitz |

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

**Prerequisites**
none

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

### V Selected Problems of Applied Reactor Physics and Exercises
2190411, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
Regular attendance: 26 h

self study 94 h

**Literature**
K. Wirtz Basics of Reactor technic Par I, II, Technic School Karlsruhe 1966 (in German)

D. Emendorfer. K.H. Höcker Theory of nuclear reactions, BI- Hochschultaschenbücher 1969 (in German)

J. Duderstadt and L. Hamilton, Nuclear reactor Analysis, J. Wiley $ Sons, Inc. 1975.

## T 3.354 Course: Seminar Data-Mining in Production [T-MACH-108737]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2151643 | Seminar Data Mining in Production | 2 SWS | Seminar (S) | Lanza |
| WS 18/19 | 2151643 | Seminar Data Mining in Production | 2 SWS | Seminar (S) | Lanza |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108737 | Seminar Data-Mining in Production | | Prüfung (PR) | Lanza |

**Competence Certificate**
alternative test achievement (graded):

- written elaboration (workload of at least 80 h)
- oral presentation (approx. 30 min)

**Prerequisites**
none

**Annotation**
The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

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

### V Seminar Data Mining in Production

2151643, SS 2018, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
**Media:**

KNIME Analytics Platform

**Learning Content**
In the age of Industry 4.0, large amounts of production data are generated by the global production networks and value chains. Their analysis enables valuable conclusions about production and lead to an increasing process efficiency. The aim of the seminar is to get to know production data analysis as an important component of future industrial projects. The students get to know the data mining tool KNIME and use it for analyses. A specific industrial use case with real production data enables practical work and offers direct references to industrial applications. The participants learn selected methods of data mining and apply them to the production data. The work within the seminar takes place in small groups on the computer. Subsequently, presentations on specific data mining methods have to be prepared.

**Annotation**
The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

**Workload**
regular attendance: 10 hours
self-study: 80 hours

V

## Seminar Data Mining in Production

2151643, WS 18/19, 2 SWS, Open in study portal

**Seminar (S)**

**Description**
**Media:**

KNIME Analytics Platform

**Notes**
The dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php. The number of students is limited to twelve.

**Learning Content**
In the age of Industry 4.0, large amounts of production data are generated by the global production networks and value chains. Their analysis enables valuable conclusions about production and lead to an increasing process efficiency. The aim of the seminar is to get to know production data analysis as an important component of future industrial projects. The students get to know the data mining tool KNIME and use it for analyses. A specific industrial use case with real production data enables practical work and offers direct references to industrial applications. The participants learn selected methods of data mining and apply them to the production data. The work within the seminar takes place in small groups on the computer. Subsequently, presentations on specific data mining methods have to be prepared.

**Annotation**
The number of students is limited to twelve. Dates and deadlines for the seminar will be announced at https://www.wbk.kit.edu/studium-und-lehre.php.

**Workload**
regular attendance: 10 hours
self-study: 80 hours

# T 3.355 Course: Seminar for Rail System Technology [T-MACH-108692]

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

**Part of:** M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 3 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2115009 | Seminar for Rail System Technology | SWS | Seminar (S) | Gratzfeld |
| WS 18/19 | 2115009 | Seminar for Rail System Technology | SWS | Seminar (S) | Gratzfeld |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-00002 | Seminar for Rail System Technology | | Prüfung (PR) | Gratzfeld |
| WS 18/19 | 76-T-MACH-00002 | Seminar for Rail System Technology | | Prüfung (PR) | Gratzfeld |

**Competence Certificate**
Examination: Writing a Seminararbeit, final presentation

**Prerequisites**
none

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

## V Seminar for Rail System Technology

2115009, SS 2018, SWS, Open in study portal

**Seminar (S)**

**Notes**
max. 10 participants

**Learning Content**

- Railway system: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact, history, challenges and future developments in the context of mega trends
- Operation: Transportation, public/regional/long-distance transport, freight service, scheduling
- System structure of railway vehicles: Tasks and classification, main systems
- Project management: definitions, project management, main and side processes, transfer to practice
- Scientific working: structuring and writing of scientific papers, literature research, scheduling (mile stones), self-management, presentation skills, using the software Citavi for literature and knowledge management, working with templates in Word, giving and taking feedback
- The learnt knowledge regarding scientific writing is used to elaborate a Seminararbeit. To this the students create a presentation, train and reflect it and finally present it to an auditorium.

**Workload**
Regular attendance: 21 hours

Self-study (writing Seminararbeit): 65 hours

Final presentation (including preparation): 4 hours

**Literature**
A bibliography is available for download (Ilias-platform).

V **Seminar for Rail System Technology** **Seminar (S)**

2115009, WS 18/19, SWS, Open in study portal

**Notes**

max. 10 participants. Please check the homepage for further information.

**Learning Content**

- Railway system: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact, history, challenges and future developments in the context of mega trends
- Operation: Transportation, public/regional/long-distance transport, freight service, scheduling
- System structure of railway vehicles: Tasks and classification, main systems
- Project management: definitions, project management, main and side processes, transfer to practice
- Scientific working: structuring and writing of scientific papers, literature research, scheduling (mile stones), self-management, presentation skills, using the software Citavi for literature and knowledge management, working with templates in Word, giving and taking feedback
- The learnt knowledge regarding scientific writing is used to elaborate a Seminararbeit. To this the students create a presentation, train and reflect it and finally present it to an auditorium.

**Workload**

Regular attendance: 21 hours

Self-study (writing Seminararbeit): 65 hours

Final presentation (including preparation): 4 hours

**Literature**

A bibliography is available for download (Ilias-platform).

## T 3.356 Course: Signals and Systems [T-ETIT-109313]

**Responsible:** Prof. Dr.-Ing. Fernando Puente León
**Organisation:** KIT Department of Electrical Engineering and Information Technology
**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102614 - Schwerpunkt: Mechatronik

| Type | Credits | Recurrence | Expansion | Version |
|---|---|---|---|---|
| Prüfungsleistung schriftlich | 6 | Each winter term | 1 terms | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2302109 | Signale und Systeme | 2 SWS | Lecture (V) | Puente León |

**Prerequisites**
none

## T 3.357 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114095 | Simulation of Coupled Systems | 2 SWS | Lecture (V) | Geimer, Daiß, Becker |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-102172 | Simulation of Coupled Systems | | Prüfung (PR) | Geimer |
| SS 2018 | 76T-MACH-105172 | Simulation of Coupled Systems | | Prüfung (PR) | Geimer |
| SS 2018 | 76-T-MACH-105172 | Simulation of Coupled Systems | | Prüfung (PR) | Geimer |
| WS 18/19 | 76T-MACH-105172 | Simulation of Coupled Systems | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105172 | Simulation of Coupled Systems | | Prüfung (PR) | Geimer |

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

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

### Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

### Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

### Recommendation

- Knowledge of ProE (ideally in actual version)
- Basic kniwledge of Matlab/Simulink
- Basic knowledge of dynamics of machnies
- Basic knowledge of hydraulics

**Annotation**
After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

**Content:**

- Basics of multi-body and hydralics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

**Literature:**

Software guide books (PDFs)

Information about wheel-type loader specifications

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

V **Simulation of Coupled Systems** **Lecture (V)**
2114095, SS 2018, 2 SWS, Open in study portal

**Learning 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

**Workload**

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

**Literature**
**Elective literature:**

- miscellaneous guides according the software-tools pdf-shaped
- information to the wheel-type loader

# T 3.358 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen
M-MACH-104434 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each summer term | 1 |

| Exams | | | | |
|---|---|---|---|---|
| WS 18/19 | 76-T-MACH-108888 | Simulation of Coupled Systems - Advance | Prüfung (PR) | Geimer |

**Competence Certificate**
Preparation of semester report

**Prerequisites**
none

## T 3.359 Course: Simulation of Optical Systems [T-MACH-105990]

**Responsible:** PD Dr.-Ing. Ingo Sieber
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102615 - Schwerpunkt: Medizintechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2105018 | Simulation of Optical Systems | 2 SWS | Lecture (V) | Sieber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105990 | Simulation of Optical Systems | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105990 | Simulation of Optical Systems | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

### V Simulation of Optical Systems
2105018, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
This lecture gives an introduction into optical system's design. The focus is on the system concept: design for manufacture, reliability in operation, as well as interactions between optical and non-optical system components are considered. Practical aspects of optical systems design like e.g. the consideration of design rules to ensure manufacturability, tolerancing of the optical system to ensure a reliable operation, and the coupling of optical and mechanical simulation tools will also be presented. Application of the acquired techniques will be deepened with the help of three case studies.

**Learning Content**
- Introduction
- Modeling, simulation, and systems design
- Basics of optics
- Properties of optical materials
- Optical imaging
- Ray tracing
- The optical design process
- Basics of the Finite-Element Method (FEM)
- The FEM design process
- Coupling of simulation tools
- Microoptical sub-systems

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

## T 3.360 Course: Simulation of the process chain of continuously fiber reinforced composite structure [T-MACH-105971]

**Responsible:** Dr.-Ing. Luise Kärger
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114107 | Simulation der Prozesskette kontinuierlich verstärkter Faserverbundbauteile | 2 SWS | Lecture (V) | Kärger |

**Competence Certificate**
oral exam, 20 minutes

**Prerequisites**
none

# T 3.361 Course: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

**Responsible:** Prof. Dr.-Ing. Thomas Schulenberg

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 2 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2170491 | Simulator Exercises Combined Cycle Power Plants | 2 SWS | Practical course (P) | Schulenberg |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105445 | Simulator Exercises Combined Cycle Power Plants | | Prüfung (PR) | Schulenberg |
| WS 18/19 | 76-T-MACH-105445 | Simulator Exercises Combined Cycle Power Plants | | Prüfung (PR) | Schulenberg |

**Competence Certificate**
oral exam (ca. 15 min)

**Prerequisites**
none

**Recommendation**
Participation at LV-No. 2170490 "Combined Cycle Power Plants" (T-MACH-105444) is recommended.

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

## V Simulator Exercises Combined Cycle Power Plants

2170491, SS 2018, 2 SWS, Open in study portal

**Practical course (P)**

**Description**
**Media:**

The power plant simulator is based on the control system of a real SIEMENS power plant. The English user surface is based on US standard.

**Learning Content**
Start-up of the power plant from scratch; load changes and shut down; dynamic response of the power plant in case of malfuctions and of sudden load changes; manual operation of selected components.

**Annotation**
Recommendation: Participation at the lecture Combined Cycle Power Plants (2170490) is recommended.

**Workload**
Regular attendance: 20 hours

Self study: 40 hours

**Literature**
Slides and other documents of the lecture Combined Cycle Power Plants.

## T 3.362 Course: Solar Thermal Energy Systems [T-MACH-106493]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| WS 18/19 | 2189400 | Solar Thermal Energy Systems | SWS | Lecture (V) | Dagan |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106493 | Solar Thermal Energy Systems | | Prüfung (PR) | Stieglitz, Dagan |
| WS 18/19 | 76-T-MACH-106493 | Solar Thermal Energy Systems | | Prüfung (PR) | Dagan, Stieglitz |

**Competence Certificate**
oral exam. 30 minutes

**Prerequisites**
none

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

### V Solar Thermal Energy Systems
2189400, WS 18/19, SWS, Open in study portal

**Lecture (V)**

**Learning Content**
I. Introduction to solar energy: Energy resources, consumption and costs

II. The sun as an energy resource:

Structure of the sun, Black body radiation, solar constant, solar spectral distribution

Sun-Earth geometrical relationship

III. Passive and active solar thermal applications.

IV. Fundamentals of thermodynamics and heat transfer

V. Solar thermal systems - solar collector-types, concentrating collectors, solar towers. Heat losses and efficiency

VII. 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.

**Workload**
Total 90 h, hereof 30 h contact hours and 60 h homework and self-studies

# T 3.363 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2193003 | Solid State Reactions and Kinetics of Phase Transformations (with exercises) | 2 SWS | Lecture (V) | Franke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-107667 | Solid State Reactions and Kinetics of Phase | | Prüfung (PR) | Seifert |
| WS 18/19 | 76-T-MACH-107667 | Solid State Reactions and Kinetics of Phase | | Prüfung (PR) | Seifert, Franke |

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

**Prerequisites**
The successful participation in Exercises for Solid State Reactions and Kinetics of Phase Transformations is the condition for the admittance to the oral exam in Solid State Reactions and Kinetics of Phase.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations must have been passed.

**Recommendation**
Bacic course in materials science and engineering

Basic course in mathematics

physical chemistry

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

## V Solid State Reactions and Kinetics of Phase Transformations (with exercises) — Lecture (V)

2193003, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
1. Crystal Defects and Mechanisms of Diffusion

2. Microscopic Description of Diffusion

3. Phenomenological Treatment

4. Diffusion Coefficients

5. Diffusion Problems; Analytical Solutions

6. Diffusion with Phase Transformation

7. Kinetics of Microstructural Transformations

8. Diffusion at Surfaces, Grain Boundaries and Dislocations

9. Numerical treatment of diffusion controlled phase transformations

**Workload**

regular attendance: 22 hours

self-study: 98 hours

**Literature**

1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.

2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.

3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.

4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.

## T 3.364 Course: Stability: from order to chaos [T-MACH-108846]

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

**Part of:** M-MACH-102595 - Wahlpflichtmodul Naturwissenschaften/Informatik/Elektrotechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2154437 | Hydrodynamic Stability: From Order to Chaos | 2 SWS | Lecture (V) | Class |

**Competence Certificate**
The study performance is considered to have been passed if all exercise assignments have been successfully processed and the final colloquium (30 minutes) has been successfully passed.

no auxiliary

**Prerequisites**
The partial performance number T-MACH-105425 "Hydrodynamic Stability: From Order to Chaos" must not be startet or completed. The partial services T-MACH-108846 "Stability: from order to chaos" (Nat/Inf/Etit) and T-MACH-105425 "Hydrodynamic Stability: From Order to Chaos" are mutually exclusive.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105425 - Hydrodynamic Stability: From Order to Chaos must not have been started.

**Recommendation**
Fluid Mechanics (T-MACH-105207)

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

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

### V Hydrodynamic Stability: From Order to Chaos
2154437, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Black board

**Learning Content**
Increasing a control parameter of a thermohydraulic system, e.g. the Reynolds number, the initial flow pattern (e.g. stationary flow) can be replaced by a different pattern (e.g. turbulent flow).

Typical hydrodynamic instabilities are summarized in the lecture.
The systematic analysis of thermohydraulic stability problems is developed for the case of Rayleigh-Bernard convection (fluid layer heated from below) and selected examples from fluid dynamics.

Covered is:

- linear stability analysis: determine limiting control parameter value up to which the basic flow pattern is stable against small perturbations.
- nonlinear reduced order modeling, capable to characterize more complex flow patterns
- Lorenz system: a generic system exhibiting chaotic behavior

**Annotation**
Lecture also offered as a block-lecture within the AREVA Nuclear Professional School (www.anps.kit.edu)

**Workload**
regulare attendance: 21h

self-study: 99h

**Literature**
Script

## T 3.365 Course: Strategic product development - identification of potentials of innovative products [T-MACH-105696]

**Responsible:** Dr.-Ing. Andreas Siebe
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102642 - Schwerpunkt: Entwicklung innovativer Geräte

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146198 | Strategic product development - identification of potentials of innovative products | 2 SWS | Lecture (V) | Siebe |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105696 | Strategic product development - identification of potentials of innovative products | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105696 | Strategic product development - identification of potentials of innovative products | | Prüfung (PR) | Albers |

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

**Prerequisites**
none

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

### V Strategic product development - identification of potentials of innovative products

**Lecture (V)**

2146198, SS 2018, 2 SWS, Open in study portal

**Learning Content**
Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

**Workload**
regular attendance: 21 h

self-study: 99 h

## T 3.366 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

**Responsible:** Dr.-Ing. Luise Kärger
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113106 | Structural Analysis of Composite Laminates | 2 SWS | Lecture (V) | Kärger |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-105970 | Strukturberechnung von Faserverbundlaminaten | | Prüfung (PR) | Henning |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

### V Structural Analysis of Composite Laminates
2113106, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Literature**

H. Altenbach, J. Altenbach, W. Kissing; Mechanics of Composite Structural Elements . ISBN 978-3-642-07411-0 Springer-Verlag Berlin Heidelberg, 2004.

E. J. Barbero: Finite Element Analysis of Composite Materials. ISBN: 1-4200-5433-3. CRC Press, Boca Raton, FL, 1. edition, 2008.

E. J. Barbero: Introduction to Composite Materials Design. CRC Press, Boca Raton, FL, 2. edition, 2011.

E. J. Barbero: Finite Element Analysis of Composite Materials Using Abaqus. ISBN: ISBN: 978-1-46-651661-8. CRC Press, Boca Raton, FL, 2013.

Isaac M. Daniel, Ori Ishai: Engineering Mechanics of Composite Materials. Oxford Univ Press; ISBN-13: 978-0195150971, 2. Edition, 2005.

Davila, C. G.; Camanho, P. P.; Rose, C. A.: Failure criteria for FRP laminates. Journal of Composite Materials 39: 323-345, 2005.

Hinton, M. J.; Kaddour, A. S.; Soden, P. D.: A comparison of the predictive capabilities of current failure theories for composite laminates, judged against experimental evidence. Composites Science and Technology 62: 1725-1797, 2002.

Puck, A.; Schürmann, H.: Failure analysis of FRP laminates by means of physically based phenomenological models. Composite Science and Technology 58: 1045-1067, 1998.

Reddy, J. N.: Mechanics of laminated composite plates and shells - Theory and Analysis. USA: CRC Press, Boca Raton, 2004.

Soden, P. D.; Kaddour, A. S.; Hinton, M. J.: Recommendations for designers and researchers resulting from the world-wide failure exercise. Composites Science and Technology 64: 589-604, 2004.

Stephen W. Tsai and J. Daniel D. Melo: Composite Materials Design and Testing. Composites Design Group, 978-0-9860845-1-5 Stanford University , 2015.

## T 3.367 Course: Structural and Phase Analysis [T-MACH-102170]

**Responsible:** Dr.-Ing. Susanne Wagner
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2125763 | Structural and phase analysis | 2 SWS | Lecture (V) | Wagner, Hinterstein |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102170 | Structural and Phase Analysis | | Prüfung (PR) | Wagner |
| WS 18/19 | 76-T-MACH-102170 | Structural and Phase Analysis | | Prüfung (PR) | Wagner |

**Competence Certificate**
Oral examination

**Prerequisites**
none

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

### V Structural and phase analysis — Lecture (V)
2125763, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
The course gives an overview to generation and detection of x-rays as well as their interaction with matter. It provides an introduction to crystallography and describes modern measurement and analysis methods of x-ray diffraction.

It is arranged in the following units:

- Generation and properties of X-Ray's
- Crystallography
- Fundamentals and application of different measuring methods
- Qualitative and quantitative phase analysis
- Texture analysis (pole figures)
- Residual stress measurements

**Workload**
regular attendance: 30 hours

self-study: 90 hours

**Literature**

1. Moderne Röntgenbeugung - Röntgendiffraktometrie für Materialwissenschaftler, Physiker und Chemiker, Spieß, Lothar / Schwarzer, Robert / Behnken, Herfried / Teichert, Gerd B.G. Teubner Verlag 2005
2. H. Krischner: Einführung in die Röntgenfeinstrukturanalyse. Vieweg 1990.
3. B.D. Cullity and S.R. Stock: Elements of X-ray diffraction. Prentice Hall New Jersey, 2001.

## T 3.368 Course: Structural Ceramics [T-MACH-102179]

**Responsible:** Prof. Dr. Michael Hoffmann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102619 - Schwerpunkt: Technische Keramik und Pulverwerkstoffe

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2126775 | Structural Ceramics | 2 SWS | Lecture (V) | Hoffmann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102179 | Structural Ceramics | | Prüfung (PR) | Hoffmann, Wagner, Schell |
| WS 18/19 | 76-T-MACH-102179 | Structural Ceramics | | Prüfung (PR) | Hoffmann, Wagner, Schell |

**Competence Certificate**
Oral examination, 20 min

**Prerequisites**
none

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

### V Structural Ceramics
2126775, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Slides for the lecture:

available under http://www.iam.kit.edu/km

**Learning Content**
The lecture gives an overview on structure and properties of the technical relevant structural ceramics silicon nitride, silicon carbide, alumina, zirconia, boron nitride and fibre-reinforced ceramics. All types of structural ceramics will be discussed in detail in terms of preparation methods of the raw materials, shaping techniques, densification, microstructural development, mechanical properties and application fields.

**Annotation**
The course will not take place every year.

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

**Literature**
W.D. Kingery, H.K. Bowen, D.R. Uhlmann, "Introduction to Ceramics", John Wiley & Sons, New York, (1976)

E. Dörre, H. Hübner, "Aluminia", Springer Verlag Berlin, (1984)

M. Barsoum, "Fundamentals of Ceramics", McGraw-Hill Series in Material Science and Enginewering (2003)

## T 3.369 Course: Structural Materials [T-MACH-100293]

**Responsible:** Dr. Karl-Heinz Lang
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174580 | Structural Materials | 4 SWS | Lecture / Practice (VÜ) | Lang |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100293 | Structural Materials | | Prüfung (PR) | Lang |
| WS 18/19 | 76-T-MACH-100293 | Structural Materials | | Prüfung (PR) | Lang |

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

**Prerequisites**
none

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

### V Structural Materials
2174580, SS 2018, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**
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

**Workload**
Precence: 42h

Self study: 138h

# T 3.370 Course: Superhard Thin Film Materials [T-MACH-102103]

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

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102637 - Schwerpunkt: Tribologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2177618 | Superhard Thin Film Materials | 2 SWS | Lecture (V) | Ulrich |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102103 | Superhard Thin Film Materials | | Prüfung (PR) | Ulrich |
| WS 18/19 | 76-T-MACH-102103 | Superhard Thin Film Materials | | Prüfung (PR) | Ulrich |

**Competence Certificate**
oral examination (ca. 30 Minuten)

**Prerequisites**
none

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

## V Superhard Thin Film Materials

2177618, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic Boronnitride

Materials of the system metall-boron-carbon-nitrogen-silicon

**Workload**
regular attendance: 22 hours
self-study: 98 hours

**Literature**
G. Kienel (Ed.): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Copies with figures and tables will be distributed

# T 3.371 Course: Supply Chain Management [T-MACH-105181]

**Responsible:** Dr.-Ing. Knut Alicke
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2117062 | Supply chain management | 3 SWS | Lecture (V) | Alicke |
| WS 18/19 | 2117063 | Übungen zu 'Supply chain management ' (mach und wiwi) | 1 SWS | Practice (Ü) | Alicke |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105181 | Supply Chain Management | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105181 | Supply Chain Management | | Prüfung (PR) | Furmans |

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

## V Supply chain management

2117062, WS 18/19, 3 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

presentations

**Learning Content**

- Bullwhip-Effect, Demand Planning & Forecasting
- Conventional planning processes (MRP + MRPII)
- Stock keeping strategy
- Data acquisition and analysis
- Design for logistics (Postponement, Mass Customization, etc.)
- Logistic partnerships (VMI, etc.)
- Distribution structures (central vs. distributed, Hub&Spoke)
- SCM-metrics (performance measurement) e-business
- Special sectors as well as guest lectures

**Workload**
regular attendance: 42 hours
self-study: 138 hours

**Literature**
Alicke, K.: Planung und Betrieb von Logistiknetzwerken

Simchi-Levi, D., Kaminsky, P.: Designing and Managing the Supply Chain

Goldratt, E., Cox, J.: The Goal

## T 3.372 Course: Sustainable Product Engineering [T-MACH-105358]

**Responsible:** Dr. Karl-Friedrich Ziegahn
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2146192 | Sustainable Product Engineering | 2 SWS | Lecture (V) | Ziegahn |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105358 | Sustainable Product Engineering | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105358 | Sustainable Product Engineering | | Prüfung (PR) | Albers |

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

**Prerequisites**
none

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

### V Sustainable Product Engineering
2146192, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
understanding of sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects

skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products

understanding of product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products

delivery of key skills such as team skills / project / self / presentation based on realistic projects

**Workload**
regular attendance: 21 h

self-study: 99 h

# T 3.373 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

**Responsible:** Dr. Ulrich Gengenbach
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102615 - Schwerpunkt: Medizintechnik
M-MACH-102633 - Schwerpunkt: Robotik
M-MACH-102647 - Schwerpunkt: Mikroaktoren und Mikrosensoren

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2106033 | System Integration in Micro- and Nanotechnology | 2 SWS | Lecture (V) | Gengenbach |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105555 | System Integration in Micro- and Nanotechnology | | Prüfung (PR) | Hagenmeyer |
| WS 18/19 | 76-T-MACH-105555 | System Integration in Micro- and Nanotechnology | | Prüfung (PR) | Hagenmeyer |

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

**Prerequisites**
none

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

## V System Integration in Micro- and Nanotechnology

2106033, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Introduction
- Definition system integration
- Integration of mechanical functions (flexures)
- Plasma treatment of surfaces
- Adhesive bonding
    - Packaging
    - Low Temperature Cofired Ceramics (LTCC)
    - Assembly of hybrid systems

- Monolithic/hybrid system integration)
- Modular system integration

- Integration of electrical/electronic functions
- Mounting techniques
- molded Interconnect Devices (MID)
- Functional printing

- Coating
- Capping
- Housing

First steps towards system integration nanotechnology

**Literature**


- A. Risse, Fertigungsverfahren der Mechatronik, Feinwerk- und Präzisionsgerätetechnik, Vieweg+Teubner Verlag Wiesbaden, 2012
- M. Madou, Fundamentals of microfabrication and nanotechnology, CRC Press Boca raton, 2012
- G. Habenicht, Kleben Grundlagen, Technologien, Anwendungen, Springer-Verlag Berlin Heidelberg, 2009
- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013

# T 3.374 Course: Systematic Materials Selection [T-MACH-100531]

**Responsible:** Dr.-Ing. Stefan Dietrich
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 3 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174576 | Systematic Materials Selection | 3 SWS | Lecture (V) | Dietrich |
| SS 2018 | 2174577 | Übungen zu 'Systematische Werkstoffauswahl' | 1 SWS | Practice (Ü) | Dietrich, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-100531 | Systematic Materials Selection | | Prüfung (PR) | Dietrich |
| WS 18/19 | 76-T-MACH-100531 | Systematic Materials Selection | | Prüfung (PR) | Dietrich |

**Competence Certificate**
The assessment is carried out as a written exam of 2 h.

**Prerequisites**
none

**Recommendation**
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

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

## V Systematic Materials Selection

**Lecture (V)**

2174576, SS 2018, 3 SWS, Open in study portal

**Learning Content**
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are deeloped. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

**Workload**
The workload for the lecture is 150 h per semester and consists of the presence during the lecture (30 h) as well as preparation and rework time at home (120 h).

**Literature**
Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

## T 3.375 Course: Technical Design in Product Development [T-MACH-105361]

**Responsible:** Markus Schmid
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2146179 | Technical Design in Product Development | 2 SWS | Lecture (V) | Schmid |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105361 | Technical Design in Product Development | | Prüfung (PR) | Albers |
| WS 18/19 | 76-T-MACH-105361 | Technical Design in Product Development | | Prüfung (PR) | Albers |

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

Only dictionnary is allowed

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Technical Design in Product Development

**Lecture (V)**

2146179, SS 2018, 2 SWS, Open in study portal

**Learning 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

**Workload**
regular attendance: 21 h

self-study: 99 h

**Literature**
Hexact (R) Lehr- und Lernportal

## T 3.376 Course: Technical Energy Systems for Buildings 1: Processes & Components [T-MACH-105559]

**Responsible:** Dr. Ferdinand Schmidt

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2157200 | Technical energy systems for buildings 1: Processes & components | 2 SWS | Lecture (V) | Schmidt |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105559 | Technical Energy Systems for Buildings 1: Processes & Components | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105559 | Technical Energy Systems for Buildings 1: Processes & Components | | Prüfung (PR) | Gabi |

**Competence Certificate**
oral exam, 30 minutes

**Prerequisites**
none

# T 3.377 Course: Technical Energy Systems for Buildings 2: System Concept [T-MACH-105560]

**Responsible:** Dr. Ferdinand Schmidt
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2158201 | Technical energy systems for buildings 2: System concepts | 2 SWS | Lecture (V) | Schmidt |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105560 | Technical Energy Systems for Buildings 2: System Concept | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105560 | Technical Energy Systems for Buildings 2: System Concept | | Prüfung (PR) | Gabi |

**Competence Certificate**
oral exam, 30 minutes

**Prerequisites**
none

## T 3.378 Course: Technology of Steel Components [T-MACH-105362]

**Responsible:** Prof. Dr.-Ing. Volker Schulze
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2174579 | Technology of steel components | 2 SWS | Lecture (V) | Schulze |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105362 | Technology of Steel Components | | Prüfung (PR) | Schulze |
| WS 18/19 | 76-T-MACH-105362 | Technology of Steel Components | | Prüfung (PR) | Schulze |

**Competence Certificate**
Oral exam, about 25 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Technology of steel components

2174579, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 21 hours
self-study: 99 hours

**Literature**
Script will be distributed within the lecture

VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984

H.-J. Eckstein: Technologie der Wärmebehandlung von Stahl, Deutscher Verlag Grundstoffindustrie, 1977

H.K.D.H. Badeshia, R.W.K. Honeycombe, Steels - Microstructure and Properties, CIMA Publishing, 3. Auflage, 2006

V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005

## T 3.379 Course: Ten Lectures on Turbulence [T-MACH-105456]

**Responsible:** Dr. Ivan Otic
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189904 | Ten lectures on turbulence | 2 SWS | Lecture (V) | Otic |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105456 | Ten Lectures on Turbulence | | Prüfung (PR) | Otic |
| WS 18/19 | 76-T-MACH-105456 | Ten Lectures on Turbulence | | Prüfung (PR) | Otic |

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Ten lectures on turbulence

2189904, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1 Introduction
2 Turbulent transport of momentum and heat
3 Statistical description of turbulence
4 Scales of turbulent ows
5 Homogeneous turbulent shear ows
6 Free turbulent shear ows
7 Wall-Bounded turbulent ows
8 Turbulence Modelling
9 Reynolds Averaged Navier-Stokes (RANS) Simulation Approach
10 Large Eddy Simulation (LES) Approach

**Workload**
**Time of attendence**: 25 hours

**Self-study**: 100 hours

**Literature**
Reference texts:
- Lecture Notes
- Presentation slides

Recommended Books:
- Pope, S. B.: Turbulent Flows. Cambridge University Press , 2003.
- Hinze J. O.: Turbulence. McGraw-Hill, 1975.

## T 3.380 Course: Theory of Stability [T-MACH-105372]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2163113 | Theory of Stability | 2 SWS | Lecture (V) | Fidlin |
| SS 2018 | 2163114 | Übungen zu Stabilitätstheorie | 2 SWS | Practice (Ü) | Fidlin, Drozdetskaya |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105372 | Theory of Stability | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105372 | Theory of Stability | | Prüfung (PR) | Fidlin |

**Competence Certificate**
oral exam, 30 min.

**Prerequisites**
none

**Recommendation**
Vibration theory, Mathematical Methods of Vibration Theory

*Below you will find excerpts from events related to this course:*

### V Theory of Stability
2163113, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
time of attendance: 39 h
self-study: 201 h

**Literature**


- Pannovko Y.G., Gubanova I.I. Stability and Oscillations of Elastic Systems, Paradoxes, Fallacies and New Concepts. Consultants Bureau, 1965.
- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.

## T 3.381 Course: Thermal Solar Energy [T-MACH-105225]

**Responsible:** Prof. Dr. Robert Stieglitz
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169472 | Thermal Solar Energy | 2 SWS | Lecture (V) | Stieglitz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105225 | Thermal Solar Energy | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-105225 | Thermal Solar Energy | | Prüfung (PR) | Stieglitz |

**Competence Certificate**
Oral examination, 30 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Thermal Solar Energy

2169472, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Baiscs of thermal solar energy (radiation, heat conduction, storage, efficiency ….) Active and passive use of solar energy. Solar collectors (design types, efficiency, system technology). Solar plants (heliostats etc.). Solar climatization.
In detail:

1 Introduction to energy requirements and evaluation of the potential use of solar thermal energy.

2 Primary energy sources SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).

3 Solar panels: schematic structure of a collector, fundamentals of efficiency, meaning of concentration and their limitations.

4 Passive solar mechanisms: heat conduction in solids and gases, radiation heat transfer in transparent and opaque bodies, selective absorber - typical materials and manufacturing processes.

5 Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits.

optional

6 Low temperature solar thermal systems: Collector variants, methods for system simulation, planning and dimensioning of systems, system design and arrest scenarios.

6 High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes

end

- Memory: energy content, storage types, storage materials, cost
- Solar Air Conditioning: Cooling capacity determination, climate, solar cooling method and evaluation of air conditioning.

**Workload**
regular attendance: 21 h
self-study: 90 h

**Literature**
supply of lecture material in printed and electronic form

Stieglitz & Heinzel; Thermische Solarenergie -Grundlagen-Technologie- Anwendungen. Springer Vieweg Verlag. 711 Seiten. ISBN 978-3-642-29474-7

## T 3.382 Course: Thermal Turbomachines I [T-MACH-105363]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169453 | Thermal Turbomachines I | 3 SWS | Lecture / Practice (VÜ) | Bauer |
| WS 18/19 | 2169454 | Tutorial - Thermal Turbo Machines I (Übungen zu Thermische Turbomaschinen I) | 2 SWS | Practice (Ü) | Bauer |
| WS 18/19 | 2169553 | Thermal Turbomachines I (in English) | 3 SWS | Lecture / Practice (VÜ) | Bauer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105363 | Thermal Turbomachines I | | Prüfung (PR) | Bauer |
| WS 18/19 | 76-T-MACH-105363 | Thermal Turbomachines I | | Prüfung (PR) | Bauer |

**Competence Certificate**
oral exam, duration 30 min.

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Thermal Turbomachines I

2169453, WS 18/19, 3 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning 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

**Workload**
regular attendance: 31,50 h
self-study: 64,40 h

**Literature**
Lecture notes (available via Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

V **Thermal Turbomachines I (in English)** **Lecture / Practice (VÜ)**
2169553, WS 18/19, 3 SWS, Open in study portal

**Learning 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

**Workload**
regular attendance: 31,50 h
self-study: 64,40 h

**Literature**
Lecture notes (available via Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

# T 3.383 Course: Thermal Turbomachines II [T-MACH-105364]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102635 - Schwerpunkt: Technische Thermodynamik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 6 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2170476 | Thermal Turbomachines II | 3 SWS | Lecture (V) | Bauer |
| SS 2018 | 2170477 | Tutorial - Thermal Turbomachines II (Übung - Thermische Turbomaschinen II) | 2 SWS | Practice (Ü) | Bauer, Mitarbeiter |
| SS 2018 | 2170553 | Thermal Turbomachines II (in English) | 3 SWS | Lecture / Practice (VÜ) | Bauer |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105364 | Thermal Turbomachines II | | Prüfung (PR) | Bauer |
| WS 18/19 | 76-T-MACH-105364 | Thermal Turbomachines II | | Prüfung (PR) | Bauer |

**Competence Certificate**
oral exam, duration: 30 min.

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Thermal Turbomachines II
2170476, SS 2018, 3 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 31,50 h
self-study: 64,40 h

**Literature**
Lecture notes (Available via internet)
Bohl, W.: Strömungsmaschinen, Bd. I,II, Vogel Verlag 1990, 1991
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
Traupel, W.: Thermische Turbomaschinen, Bd. I,II, Springer-Verlag, 1977, 1982

V **Thermal Turbomachines II (in English)** **Lecture / Practice (VÜ)**
2170553, SS 2018, 3 SWS, Open in study portal

**Learning 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

**Workload**
regular attendance: 31,50 h
self-study: 64,40 h

**Literature**
Lecture notes (available via Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

## T 3.384 Course: Thermal-Fluid-Dynamics [T-MACH-106372]

**Responsible:** Dr. Sebastian Ruck
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2189423 | Thermal-Fluid-Dynamics | 2 SWS | Lecture (V) | Ruck |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106372 | Thermal-Fluid-Dynamics | | Prüfung (PR) | Stieglitz |
| WS 18/19 | 76-T-MACH-106372 | Thermal-Fluid-Dynamics | | Prüfung (PR) | Ruck, Stieglitz |

**Competence Certificate**
oral exam of about 30 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Thermal-Fluid-Dynamics
2189423, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Main Issues**

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Statistic description and analytics of turbulent flows
- Thermal boundary layer equations
- Velocity and temperature laws in boundary layers
- Convective Heat transfer of external and internal flows
- Analogies ( Prandtl-, von Kárman, Martinelli,…)
- Methods for enhancing heat transfer
- Strategies and methods for experimental and numerical investigation of thermal-hydraulics in R&D

**Learning Content**
The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. Conservation equations are discussed. Based on the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. The statistical concepts for describing turbulent flows and the corresponding transport equations are introduced. Analysis of thermal and turbulent measurement signals are discussed.

Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, the thermal boundary layer equations are introduced for the laminar and turbulent case. Velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed; turbulence modelling and scale-resolving methods and their applicability for different conditions or heat transfer fluids are described in the following. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Furthermore, design options to enhance the efficiency of heat exchangers are discussed.

Solution strategies and best practical guidelines of the aforementioned methods are provided.

**Workload**
Attendance time: 21 h

Preparation/follow-up time of lectures, exam preparation: 90h

**Literature**
Literature are specified in the corresponding lectures. Teaching materials are provided online at http://ilias.studium.kit.edu. Hardcopy script for special topics during the lecture.

## T 3.385 Course: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

**Responsible:** Dr. Patric Gruber
Dr. Ruth Schwaiger
Dr. Daniel Weygand

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102649 - Schwerpunkt: Advanced Materials Modelling

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2178123 | Thin film and small-scale mechanical behavior | 2 SWS | Lecture (V) | Weygand, Schwaiger, Brandl, Gruber |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105554 | Thin Film and Small-scale Mechanical Behavior | | Prüfung (PR) | Gruber, Weygand |
| WS 18/19 | 76-T-MACH-105554 | Thin Film and Small-scale Mechanical Behavior | | Prüfung (PR) | Gruber, Weygand |

**Competence Certificate**
oral exam

## T 3.386 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

**Responsible:** Dr.-Ing. Günter Leister
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114845 | Tires and Wheel Development for Passenger Cars | 2 SWS | Lecture (V) | Leister |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102207 | Tires and Wheel Development for Passenger Cars | | Prüfung (PR) | Leister |
| WS 18/19 | 76-T-MACH-102207 | Tires and Wheel Development for Passenger Cars | | Prüfung (PR) | Leister |

**Competence Certificate**
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Tires and Wheel Development for Passenger Cars
2114845, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology incuding Design and manifacturing methods, Wheeltesting
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**
Manuscript to the lecture

# T 3.387 Course: Tractors [T-MACH-105423]

**Responsible:** Simon Becker
Prof. Dr.-Ing. Marcus Geimer
Dr. Martin Kremmer

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113080 | Tractors | 2 SWS | Block lecture (BV) | Kremmer, Becker |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105423 | Tractors | | Prüfung (PR) | Geimer |
| WS 18/19 | 76-T-MACH-105423 | Tractors | | Prüfung (PR) | Geimer |

**Competence Certificate**
The assessment consists of an written exam taking place in the recess period (90 min).

**Prerequisites**
none

**Recommendation**
Basic knowledge in mechanical engineering.

**Annotation**
**Learning Outcomes**
After completion of the course the Students know:

- important problems in agritechnological developments
- Customer requirements and their implementation in tractors
- Tractor technology in width and depth

**Content**
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies
During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.
In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

**Literature**

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

*Below you will find excerpts from events related to this course:*

| V | **Tractors** 2113080, WS 18/19, 2 SWS, Open in study portal | **Block lecture (BV)** |
|---|---|---|

**Learning Content**
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fullfilled with high-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical backround, legal requirements, ways of development, agricultural organizations and the proces of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

**Workload**

- regular attendance: 21 hours
- self-study: 92 hours

**Literature**

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

## T 3.388 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-102599 - Schwerpunkt: Antriebssysteme
M-MACH-102637 - Schwerpunkt: Tribologie
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 8 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2181114 | Tribology | 5 SWS | Lecture / Practice (VÜ) | Dienwiebel, Scherge |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105531 | Tribology | | Prüfung (PR) | Dienwiebel |
| WS 18/19 | 76-T-MACH-105531 | Tribology | | Prüfung (PR) | Dienwiebel |

**Competence Certificate**
oral examination (ca. 40 min)

no tools or reference materials

**Prerequisites**
admission to the exam only with successful completion of the exercises [T-MACH-109303]

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-109303 - Exercices - Tribology must have been passed.

**Recommendation**
preliminary knowlegde in mathematics, mechanics and materials science

*Below you will find excerpts from events related to this course:*

### V Tribology

2181114, WS 18/19, 5 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning Content**

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, evironmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Stribeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

**Workload**
regular attendance: 45 hours
self-study: 195 hours

**Literature**


1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

# T 3.389 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169462 | Turbine and compressor Design | 2 SWS | Lecture (V) | Bauer, Schulz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105365 | Turbine and Compressor Design | | Prüfung (PR) | Schulz, Bauer |
| WS 18/19 | 76-T-MACH-105365 | Turbine and Compressor Design | | Prüfung (PR) | Bauer, Schulz |

**Competence Certificate**
oral exam, duration: 20 min.

**Prerequisites**
Exams Thermal Turbomachinery I & II successfully passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105363 - Thermal Turbomachines I must have been passed.
2. The course T-MACH-105364 - Thermal Turbomachines II must have been passed.

*Below you will find excerpts from events related to this course:*

## V Turbine and compressor Design — Lecture (V)
2169462, WS 18/19, 2 SWS, Open in study portal

**Learning Content**
The lecture is intended to expand the knowledge from Thermal Turbomachines I+II.

Thermal Turbomaschines, general overview

Design of a turbomachine: Criteria and development

Radial machines

Transonic compressors

Combustion chambers

Multi-spool installations

**Workload**
regular attendance: 21 h
self-study: 42 h

**Literature**
Münzberg, H.G.: Gasturbinen - Betriebsverhalten und Optimierung, Springer Verlag, 1977

Traupel, W.: Thermische Turbomaschinen, Bd. I-II, Springer Verlang, 1977, 1982

## T 3.390 Course: Turbo Jet Engines [T-MACH-105366]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Events** | | | | | |
| SS 2018 | 2170478 | Turbo Jet Engines | 2 SWS | Lecture (V) | Bauer, Schulz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105366 | Turbo Jet Engines | | Prüfung (PR) | Bauer, Schulz |
| WS 18/19 | 76-T-MACH-105366 | Turbo Jet Engines | | Prüfung (PR) | Bauer, Schulz |

**Competence Certificate**
oral exam, duration: 20 min.

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Turbo Jet Engines
2170478, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Introduction to jet engines and their components

Demands on engines and propulsive efficiency

Thermodynamic and gas dynamic fundamentals and design calculations

Components of air breathing engines

Jet engine design and development process

Engine and component design

Current developments in the jet engines industry

**Workload**
regular attendance:21 h
self-study: 42 h

**Literature**
Hagen, H.: Fluggasturbinen und ihre Leistungen, G. Braun Verlag, 1982
Hünnecke, K.: Flugtriebwerke, ihre Technik und Funktion, Motorbuch Verlag, 1993
Saravanamuttoo, H.; Rogers, G.; Cohen, H.: Gas Turbine Theory, 5th Ed., 04/2001
Rolls-Royce: The Jet Engine, ISBN:0902121235, 2005

## T 3.391 Course: Tutorial Mathematical Methods in Strength of Materials [T-MACH-106830]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161255 | Übungen zu Mathematische Methoden der Festigkeitslehre | 2 SWS | Practice (Ü) | Wicht, Böhlke |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106830 | Tutorial Mathematical Methods in Strength of Materials | | Prüfung (PR) | Böhlke |

### Competence Certificate
successfully solving the homework sheets. Details are announced in the first lecture.

Passing this course allows registration to the exam "Mathematical Methods in Strength of Materials" (Teilleistung T-MACH-100297)

### Prerequisites
None

## T 3.392 Course: Tutorial Mathematical Methods in Structural Mechanics [T-MACH-106831]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102594 - Mathematische Methoden
M-MACH-102602 - Schwerpunkt: Zuverlässigkeit im Maschinenbau
M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 0 | Each summer term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2162281 | Übungen zu 'Mathematische Methoden der Strukturmechanik' | 1 SWS | Practice (Ü) | Kehrer, Böhlke |
| **Exams** | | | | | |
| SS 2018 | 76T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | | Prüfung (PR) | Böhlke |
| WS 18/19 | 76-T-MACH-106831 | Tutorial Mathematical Methods in Structural Mechanics | | Prüfung (PR) | Böhlke |

## T 3.393 Course: Two-Phase Flow and Heat Transfer [T-MACH-105406]

**Responsible:** Prof. Dr.-Ing. Thomas Schulenberg
Dr. Martin Wörner

**Organisation:** KIT Department of Chemical and Process Engineering
KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102608 - Schwerpunkt: Kerntechnik
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Version |
|---|---|---|
| Prüfungsleistung mündlich | 4 | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2169470 | Two-Phase Flow and Heat Transfer | 2 SWS | Lecture (V) | Wörner, Schulenberg |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105406 | Two-Phase Flow and Heat Transfer | | Prüfung (PR) | Schulenberg |
| WS 18/19 | 76-T-MACH-105406 | Two-Phase Flow and Heat Transfer | | Prüfung (PR) | Schulenberg |

**Competence Certificate**
oral exam, duration: approximately 30 minutes

no tools or reference materials may be used during the exam

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Two-Phase Flow and Heat Transfer
2169470, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
Media:

Power Point presentations

Excel analyses

**Learning Content**

- 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

**Annotation**
Recommendations: Basics of fluid mechanics and thermodynamics are a mandatory requirement.

**Workload**
regular attendance: 21 h
self-study: 99 h

**Literature**
lecture notes

# T 3.394 Course: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

**Responsible:** Dr. Beate Bornschein
Dr. Christian Day

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102643 - Schwerpunkt: Fusionstechnologie

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2190499 | Vacuum and Tritium Technology in Nuclear Fusion | 2 SWS | Block lecture (BV) | Day, Bornschein, Frances |

**Competence Certificate**
oral examination, 20 Minutes, any time in the year

**Prerequisites**
none

**Recommendation**
Knowledge in ´Fusion Technology A´

# T 3.395 Course: Value stream within enterprises – The value chain at Bosch [T-MACH-106375]

**Responsible:** Dr. Rudolf Maier
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102824 - Schlüsselqualifikationen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 2 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2149661 | Der Wertstrom im Industrieunternehmen - Am Beispiel der Wertschöpfungskette bei Bosch | 2 SWS | Seminar (S) | Maier |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106375 | Value stream within enterprises – The value chain at Bosch | | Prüfung (PR) | Maier |

**Competence Certificate**
alternative achievement (ungraded):
- attendance on at least 12 lecture units

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Der Wertstrom im Industrieunternehmen - Am Beispiel der Wertschöpfungskette bei Bosch

**Seminar (S)**

2149661, WS 18/19, 2 SWS, Open in study portal

**Description**
Lecture notes will be provided in Ilias
(https://ilias.studium.kit.edu/)

**Notes**
The registration for the seminar is via Ilias. (https://ilias.studium.kit.edu/)
The password will be announced in the first appointment.

**Learning Content**
The seminar provides an insight into the main functional units of a company and their typical processes by using Bosch as an example. Furthermore it is based on discussions with the students. Former Bosch top managers explain the essential business processes and functions of the individual departments as well as the classic tasks of an engineer in a worldwide operating automotive supplier. The seminar also provides an insight into the careers of the Bosch directors. In addition to the company processes, the seminar will therefore focus on reports of challenges, successes, failures and product and process innovations.
The topics are as follows:

- Introduction, strategy, innovation
- R&D, product development process
- Production
- Quality management
- Market, marketing, sales
- Aftermarket, service
- Finance, controlling
- Logistics
- Purchasing, supply chain
- IT
- HR, leadership, compliance

**Workload**
regular attendance: 21 hours
self-study: 39 hours

## T 3.396 Course: Vehicle Comfort and Acoustics I [T-MACH-105154]

**Responsible:** Prof. Dr. Frank Gauterin
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114856 | Vehicle Ride Comfort & Acoustics I | 2 SWS | Lecture (V) | Gauterin |
| WS 18/19 | 2113806 | Vehicle Comfort and Acoustics I | 2 SWS | Lecture (V) | Gauterin |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105154 | Vehicle Comfort and Acoustics I | | Prüfung (PR) | Gauterin |
| WS 18/19 | 76-T-MACH-105154 | Vehicle Comfort and Acoustics I | | Prüfung (PR) | Gauterin |

**Competence Certificate**
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
Can not be combined with lecture T-MACH-102206

*Below you will find excerpts from events related to this course:*

### V Vehicle Ride Comfort & Acoustics I

2114856, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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.

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

The script will be supplied in the lectures

**V** **Vehicle Comfort and Acoustics I**
2113806, WS 18/19, 2 SWS, Open in study portal **Lecture (V)**

**Learning 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.

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

The script will be supplied in the lectures

# T 3.397 Course: Vehicle Comfort and Acoustics II [T-MACH-105155]

**Responsible:** Prof. Dr. Frank Gauterin
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102650 - Schwerpunkt: Verbrennungsmotorische Antriebssysteme
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2114825 | Vehicle Comfort and Acoustics II | 2 SWS | Lecture (V) | Gauterin |
| SS 2018 | 2114857 | Vehicle Ride Comfort & Acoustics II | 2 SWS | Lecture (V) | Gauterin |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105155 | Vehicle Comfort and Acoustics II | | Prüfung (PR) | Gauterin |
| WS 18/19 | 76-T-MACH-105155 | Vehicle Comfort and Acoustics II | | Prüfung (PR) | Gauterin |

**Competence Certificate**
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

**Prerequisites**
Can not be combined with lecture T-MACH-102205

*Below you will find excerpts from events related to this course:*

## V Vehicle Comfort and Acoustics II

2114825, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning 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

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**
The script will be supplied in the lectures.

**V** **Vehicle Ride Comfort & Acoustics II** **Lecture (V)**
2114857, SS 2018, 2 SWS, Open in study portal

**Notes**
The lecture starts in June 2016. Exact date of beginning: see homepage of institute.

**Learning 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

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**
The script will be supplied in the lectures.

## T 3.398 Course: Vehicle Ergonomics [T-MACH-108374]

**Responsible:** Dr.-Ing. Tobias Heine
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102600 - Schwerpunkt: Mensch - Technik - Organisation
M-MACH-102605 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102630 - Schwerpunkt: Mobile Arbeitsmaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2110050 | Vehicle Ergonomics | 2 SWS | Seminar (S) | Heine |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-108374 | Vehicle Ergonomics | | Prüfung (PR) | |

**Competence Certificate**
written exam, 60 minutes

**Prerequisites**
none

## T 3.399 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-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102628 - Schwerpunkt: Leichtbau
M-MACH-102632 - Schwerpunkt: Polymerengineering
M-MACH-102641 - Schwerpunkt: Bahnsystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113102 | Vehicle Lightweight design – Strategies, Concepts, Materials | 2 SWS | Lecture (V) | Henning |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | | Prüfung (PR) | Henning |
| WS 18/19 | 76-T-MACH-105237 | Vehicle Lightweight Design - Strategies, Concepts, Materials | | Prüfung (PR) | Henning |

**Competence Certificate**
Written exam, 90 minutes

**Prerequisites**
none

**Recommendation**
none

*Below you will find excerpts from events related to this course:*

### V Vehicle Lightweight design – Strategies, Concepts, Materials

2113102, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
strategies in lightweight design
shape optimization, light weight materials, multi-materials and concepts for lightweight design

construction methods
differential, integral, sandwich, modular, bionic

body construction
shell, space frame, monocoque

metalic materials
steal, aluminium, magnesium, titan

**Workload**
lectures: 21h, preparation of examination: 79h

# T 3.400 Course: Vehicle Mechatronics I [T-MACH-105156]

**Responsible:** Prof. Dr.-Ing. Dieter Ammon
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-102607 - Schwerpunkt: Kraftfahrzeugtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2113816 | Vehicle Mechatronics I | 2 SWS | Lecture (V) | Ammon |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105156 | Vehicle Mechatronics I | | Prüfung (PR) | Ammon |
| WS 18/19 | 76-T-MACH-105156 | Vehicle Mechatronics I | | Prüfung (PR) | Ammon |

**Competence Certificate**
Written examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Vehicle Mechatronics I

2113816, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
1. Introduction: Mechatronics in vehicle technology
2. Vehicle Control systems
Brake- and traction controls (ABS, ASR, automated power train controls)
Active and semiactive suspension systems, active stabilizor bars
Vehicle dynamics controls, driver assistence systems
3. Modelling technology
Mechanics - multi body dynamics
Electrical and electronical systems, control systems
Hydraulics
Interdisciplinary coupled systems
4. Computer simulation technology
Numerical integration methods
Quality (validation, operating areas, accuracy, performance)
Simulator-coupling (hardware-in-the-loop, software-in-the-loop)
5. Systemdesign (example: brake control)
Demands, requirements (funktion, safety, robustness)
Problem setup (analysis - modelling - model reduction)
Solution approaches
Evaluation (quality, efficiency, validation area, concept ripeness)

**Workload**
regular attendance: 22,5 hours
self-study: 97,5 hours

**Literature**

1. Ammon, D., Modellbildung und Systementwicklung in der Fahrzeugdynamik, Teubner, Stuttgart, 1997
2. Mitschke, M., Dynamik der Kraftfahrzeuge, Bände A-C, Springer, Berlin, 1984ff
3. Miu, D.K., Mechatronics - Electromechanics and Contromechanics, Springer, New York, 1992
4. Popp, K. u. Schiehlen, W., Fahrzeugdynamik - Eine Einführung in die Dynamik des Systems Fahrzeug-Fahrweg, Teubner, Stuttgart, 1993
5. Roddeck, W., Einführung in die Mechatronik, Teubner, Stuttgart, 1997
6. Zomotor, A., Fahrwerktechnik: Fahrverhalten, Vogel, Würzburg, 1987

# T 3.401 Course: Vibration Theory [T-MACH-105290]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
M-MACH-102405 - Grundlagen und Methoden des Maschinenbaus
M-MACH-102575 - Grundlagen und Methoden der Energie- und Umwelttechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen
M-MACH-102646 - Schwerpunkt: Angewandte Mechanik
M-MACH-102739 - Grundlagen und Methoden der Fahrzeugtechnik
M-MACH-102740 - Grundlagen und Methoden der Mechatronik und Mikrosystemtechnik
M-MACH-102741 - Grundlagen und Methoden der Produktentwicklung und Konstruktion
M-MACH-102742 - Grundlagen und Methoden der Produktionstechnik
M-MACH-102743 - Grundlagen und Methoden des Theoretischen Maschinenbaus
M-MACH-102744 - Grundlagen und Methoden der Werkstoffe und Strukturen für Hochleistungssysteme
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 5 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161212 | Vibration Theory | 2 SWS | Lecture (V) | Fidlin |
| WS 18/19 | 2161213 | Übungen zu Technische Schwingungslehre | 2 SWS | Practice (Ü) | Fidlin, Leister |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105290 | Vibration Theory | | Prüfung (PR) | Fidlin |
| WS 18/19 | 76-T-MACH-105290 | Vibration Theory | | Prüfung (PR) | Fidlin |

**Competence Certificate**
written exam, 180 min.

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Vibration Theory

2161212, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

**Workload**
time of attendance: 22,5 h; self-study: 128 h

**Literature**

Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd 1 and Bd 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

# T 3.402 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 3122031 | Virtual Engineering (Specific Topics) | 2 SWS | Lecture (V) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105381 | Virtual Engineering (Specific Topics) | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-105381 | Virtual Engineering (Specific Topics) | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
oral exam, 20 min.

**Prerequisites**
none

# T 3.403 Course: Virtual Engineering I [T-MACH-102123]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2121352 | Virtual Engineering I | 2 SWS | Lecture (V) | Ovtcharova |
| WS 18/19 | 2121353 | Exercises Virtual Engineering I | 2 SWS | Practice (Ü) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102123 | Virtual Engineering I | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102123 | Virtual Engineering I | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Writen examination 90 min.

**Prerequisites**
None

*Below you will find excerpts from events related to this course:*

## V Virtual Engineering I

2121352, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture notes

**Learning Content**
The lecture communicates IT aspects required for understanding virtual product development processes. For this purpose, the focus is set on systems used in industry supporting the process chain of Virtual Engineering:

- Product Lifecycle Management is an approach for managing product related data across the entire lifecycle of the product, beginning with the concept phase until disassembling and recycling.
- CAx-systems for virtual product development allow modeling digital products regarding design, construction, manufacturing and maintenance.
- Validation systems enable the analysis of products regarding statics, dynamics, safety and manufacturing feasibility.

The objective of the lecture is to clarify the relationship between construction and validation operations by applying virtual prototypes and VR/AR/MR visualization techniques in combination with PDM/PLM-systems. This is taught by introducing each particular system in applied exercises.

## V Exercises Virtual Engineering I

2121353, WS 18/19, 2 SWS, Open in study portal

**Practice (Ü)**

**Learning Content**
In this module, the practical application of different CAx software systems is exemplarily conducted in small groups, the main focus being the CAD systems CATIA V5 (DASSAULT SYSTEMES) and NX 5 (Siemens PLM Software).

**Workload**
Regular attendance: 31,5 hours, self-study: 10,5 hours

**Literature**
Exercise notes

## T 3.404 Course: Virtual Engineering II [T-MACH-102124]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2122378 | Virtual Engineering II | 2 SWS | Lecture (V) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102124 | Virtual Engineering II | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102124 | Virtual Engineering II | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Writen examination 90 min.

**Prerequisites**
None

*Below you will find excerpts from events related to this course:*

### V Virtual Engineering II

2122378, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

Lecture notes

**Learning Content**
The lecture presents the IT aspects required for understanding virtual product development processes:

- Corresponding models can be visualized in Virtual Reality Systems, from individual parts to complete assembles.
- Virtual Prototypes combine CAD-data and information about properties of components and assemblies for immersive visualization, functionality tests and functional validation in VR/AR/MR environments.
- Integrated Virtual Product Development explains product development processes from the point of view of Virtual Engineering.

The objective of this lecture is to clarify the relationship between construction and validation operations by using virtual prototypes and VR/AR/MR visualization techniques in combination with PDM/PLM-systems. This will be achieved by introducing each particular IT-system with practical-oriented exercises.

# T 3.405 Course: Virtual Engineering Lab [T-MACH-106740]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| **Events** | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123350 | Virtual Engineering Lab | SWS | Practical course (P) | Ovtcharova |
| WS 18/19 | 2123350 | Virtual Engineering Lab | SWS | Project (PRO) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106740 | Virtual Engineering Lab | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-106740 | Virtual Engineering Lab | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Assessment of another type (graded), procedure see webpage.

## T 3.406 Course: Virtual Reality Practical Course [T-MACH-102149]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102612 - Schwerpunkt: Modellierung und Simulation in der Energie- und Strömungstechnik
M-MACH-102614 - Schwerpunkt: Mechatronik
M-MACH-102633 - Schwerpunkt: Robotik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2123375 | Virtual Reality Practical Course | 3 SWS | Project (PRO) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-102149 | Virtual Reality Practical Course | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-102149 | Virtual Reality Practical Course | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Assessment of another type (graded)

**Prerequisites**
None

**Annotation**
Number of participants is limited

*Below you will find excerpts from events related to this course:*

### V Virtual Reality Practical Course

2123375, WS 18/19, 3 SWS, Open in study portal

**Project (PRO)**

**Learning Content**
The lab course consists of:

1. Introduction and basics in virtual reality (hardware, software, application)
2. Introduction in 3DVIA Virtools tool kit as an application development system
3. IMplermentation and practice by developing a driving simulator in small groups.

## T 3.407 Course: Virtual training factory 4.X [T-MACH-106741]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102613 - Schwerpunkt: Lifecycle Engineering

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung anderer Art | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2123351 | Virtual training factory 4.X | SWS | Lecture (V) | Ovtcharova |
| WS 18/19 | 2123351 | Virtual training factory 4.X | SWS | Seminar / Practical course (S/P) | Ovtcharova, Mitarbeiter |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-106741 | Virtual training factory 4.X | | Prüfung (PR) | Ovtcharova |
| WS 18/19 | 76-T-MACH-106741 | Virtual training factory 4.X | | Prüfung (PR) | Ovtcharova |

**Competence Certificate**
Assessment of another type (graded), procedure see webpage.

# T 3.408 Course: Vortex Dynamics [T-MACH-105784]

**Responsible:** Dr. Jochen Kriegseis
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2153438 | Vortex Dynamics | 2 SWS | Lecture (V) | Kriegseis |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105784 | Vortex Dynamics | | Prüfung (PR) | Kriegseis |
| WS 18/19 | 7600006 | Vortex Dynamics | | Prüfung (PR) | Kriegseis |
| WS 18/19 | 76-T-MACH-105784 | Vortex Dynamics | | Prüfung (PR) | |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Vortex Dynamics

2153438, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Definition of a vortex
- Theoretical description of vortex flow
- Steady and time-dependent solutions of vortex flows
- Helmholtz's vortex theorems
- Vorticity equation
- Properties of various vortical structures
- Introduction of various vortec identification approaches

**Workload**
regulare attendance: 20h
Self-study: 100h

**Literature**
Spurk, J.H.: Fluid Mechanics, Springer, 1996
Green, S.I.: Fluid Vortices, Kluwer Academic Publishers, 1995

Wu, J.-Z. et al.: Vorticity and Vortex Dynamics, Springer, 2006

Saffman, P.G.: Vortex Dynamics, Cambrigde University Press, 1992

# T 3.409 Course: Warehousing and Distribution Systems [T-MACH-105174]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102618 - Schwerpunkt: Produktionstechnik
M-MACH-102625 - Schwerpunkt: Informationstechnik für Logistiksysteme
M-MACH-102629 - Schwerpunkt: Logistik und Materialflusslehre
M-MACH-102640 - Schwerpunkt: Technische Logistik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each summer term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2118097 | Warehousing and distribution systems | 2 SWS | Lecture (V) | Furmans |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105174 | Warehousing and Distribution Systems | | Prüfung (PR) | Furmans |
| WS 18/19 | 76-T-MACH-105174 | Warehousing and Distribution Systems | | Prüfung (PR) | Furmans, Mittwollen |

**Competence Certificate**
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Warehousing and distribution systems

2118097, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Description**
**Media:**

presentations, black board

**Learning Content**

- Introduction
- Yard management
- Receiving
- Storage and picking
- Workshop on cycle times
- Consoldiation and packing
- Shipping
- Added Value
- Overhead
- Case Study: DCRM
- Planning of warehouses
- Case study: Planning of warehouses
- Distribution networks
- Lean Warehousing

**Annotation**
none

**Workload**
regular attendance: 21 hours
self-study: 99 hours

**Literature**

**ARNOLD, Dieter, FURMANS, Kai (2005)**
Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag

**ARNOLD, Dieter (Hrsg.) et al. (2008)**
Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag

**BARTHOLDI III, John J., HACKMAN, Steven T. (2008)**
Warehouse Science

**GUDEHUS, Timm (2005)**
Logistik, 3. Auflage, Berlin: Springer-Verlag

**FRAZELLE, Edward (2002)**
World-class warehousing and material handling, McGraw-Hill

**MARTIN, Heinrich (1999)**
Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg

**WISSER, Jens (2009)**
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe : Universitätsverlag

A comprehensive overview of scientific papers can be found at:

**ROODBERGEN, Kees Jan (2007)**
Warehouse Literature

# T 3.410 Course: Wave Propagation [T-MACH-105443]

**Responsible:** Prof. Dr.-Ing. Wolfgang Seemann
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102598 - Schwerpunkt: Advanced Mechatronics
M-MACH-102601 - Schwerpunkt: Automatisierungstechnik
M-MACH-102606 - Schwerpunkt: Fahrdynamik, Fahrzeugkomfort und -akustik
M-MACH-104443 - Schwerpunkt: Schwingungslehre

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2161219 | Wave Propagation | 2 SWS | Lecture (V) | Seemann |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105443 | Wave Propagation | | Prüfung (PR) | Seemann |
| WS 18/19 | 76-T-MACH-105443 | Wave Propagation | | Prüfung (PR) | Seemann |

**Competence Certificate**
oral exam, 30 min.

**Prerequisites**
T-MACH-105290 - Technische Schwingungslehre

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105290 - Vibration Theory must have been passed.

## T 3.411 Course: Welding Technology [T-MACH-105170]

**Responsible:** Dr. Majid Farajian
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102611 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik
M-MACH-102618 - Schwerpunkt: Produktionstechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each winter term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2173571 | Welding Technology | 2 SWS | Lecture (V) | Farajian |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105170 | Welding Technology | | Prüfung (PR) | Farajian |
| WS 18/19 | 76-T-MACH-105170 | Welding Technology | | Prüfung (PR) | Farajian |

**Competence Certificate**
Oral exam, about 20 minutes

**Prerequisites**
none

**Recommendation**
Basics of material science (iron- and non-iron alloys), materials, processes and production, design.

All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

*Below you will find excerpts from events related to this course:*

### V Welding Technology — Lecture (V)
2173571, WS 18/19, 2 SWS, Open in study portal

**Learning 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

**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).

**Literature**

Für ergänzende, vertiefende Studien gibt das

Handbuch der Schweißtechnik von J. Ruge, Springer Verlag Berlin, mit seinen vier Bänden

Band I: Werkstoffe

Band II: Verfahren und Fertigung

Band III: Konstruktive Gestaltung der Bauteile

Band IV: Berechnung der Verbindungen

einen umfassenden Überblick. Der Stoff der Vorlesung Schweißtechnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweißverfahren bietet das Bändchen

Nies: Lichtbogenschweißtechnik, Bibliothek der Technik Band 57, Verlag moderne Industrie AG und Co., Landsberg / Lech

Im Übrigen sei auf die zahlreichen Fachbücher des DVS Verlages, Düsseldorf, zu allen Einzelgebieten der Fügetechnik verwiesen.

# T 3.412 Course: Windpower [T-MACH-105234]

**Responsible:** Dr. Norbert Lewald
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102627 - Schwerpunkt: Kraft- und Arbeitsmaschinen
M-MACH-102634 - Schwerpunkt: Strömungsmechanik
M-MACH-102648 - Schwerpunkt: Gebäudeenergietechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung schriftlich | 4 | Each winter term | 2 |

| Events | | | | | |
|---|---|---|---|---|---|
| WS 18/19 | 2157381 | Windpower | 2 SWS | Event (Veranst.) | Lewald, Pritz |
| **Exams** | | | | | |
| SS 2018 | 76-T-MACH-105234 | Windpower | | Prüfung (PR) | Gabi |
| WS 18/19 | 76-T-MACH-105234 | Windpower | | Prüfung (PR) | Gabi |

**Competence Certificate**
written exam, 120 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V Windpower

2157381, WS 18/19, 2 SWS, Open in study portal

**Event (Veranst.)**

**Description**
**Media:**

A scriptum that has to be overhault is available under www.ieh.kit.edu under “Studium und Lehre”. Further book titles or relevant websites will be announced in the lecture.

**Learning Content**
The lecture contacts due to the broadly basic knowledge to all listeners of all terms.

On the basis of an overview of alternative, renewable energy technologies as well as general energy data, the entrance is transacted into the wind energy by means of an overview of the historical development of the wind force.

Since the wind supplies the driving power as indirect solar energy, the global and the local wind systems as well as their measurement and energy content are dedicated to its own chapter.

Whereupon constructing the aerodynamic bases and connections of wind-power plants and/or their profiles are described. The electrical system of the wind-power plants forms a further emphasis. Begun of fundamental generator technology over control and controlling of the energy transfer.

After the emphasis aerodynamics and electrical system the further components of wind-power plants and their characteristics in the connection are described.

Finally the current economic, ecological and legislations boundary conditions for operating wind-power plants are examined.

In addition to wind-power plants for electricity production, the lecture is also shortly aiming at alternative use possibilities such as pumping systems.

Finally an overview of current developments like super-grids and visions of the future of the wind power utilization will be given.

## T 3.413 Course: Workshop on computer-based flow measurement techniques [T-MACH-106707]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102591 - Laborpraktikum
M-MACH-102610 - Schwerpunkt: Kraftwerkstechnik
M-MACH-102623 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102636 - Schwerpunkt: Thermische Turbomaschinen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2171488 | Workshop on computer-based flow measurement techniques | 3 SWS | Practical course (P) | Bauer, Mitarbeiter |
| WS 18/19 | 2171488 | Workshop on computer-based flow measurement techniques | 3 SWS | Practical course (P) | Bauer, Mitarbeiter |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-106707 | Workshop on computer-based flow measurement techniques | | Prüfung (PR) | Bauer |

**Competence Certificate**
Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

### V Workshop on computer-based flow measurement techniques

2171488, SS 2018, 3 SWS, Open in study portal

**Practical course (P)**

**Learning Content**
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

**Annotation**
Registration during the lecture period via the website.

**Workload**
regular attendance: 52,5
self-study: 67,5

**Literature**
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

V **Workshop on computer-based flow measurement techniques** **Practical course (P)**
2171488, WS 18/19, 3 SWS, Open in study portal

**Learning Content**
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

**Annotation**
Registration during the lecture period via the website.

**Workload**
regular attendance: 52,5
self-study: 67,5

**Literature**
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

# T 3.414 Course: X-ray Optics [T-MACH-109122]

**Responsible:** Dr. Arndt Last
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102597 - Wahlpflichtmodul Maschinenbau
M-MACH-102616 - Schwerpunkt: Mikrosystemtechnik

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Prüfungsleistung mündlich | 4 | Each term | 1 |

| Events | | | | | |
|---|---|---|---|---|---|
| SS 2018 | 2141007 | Röntgenoptik | 2 SWS | Lecture (V) | Last |
| WS 18/19 | 2141007 | X-ray Optics | 2 SWS | Lecture (V) | Last |
| **Exams** | | | | | |
| WS 18/19 | 76-T-MACH-109122 | X-ray Optics | | Prüfung (PR) | Last |

**Competence Certificate**
oral exam (about 20 min)

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

## V X-ray Optics

2141007, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**
The lecture covers general principles of optics as well as basics, functioning and application of reflective, refractive and diffractive X-ray optical elements and systems. Selected X-ray analytical imaging methods and the necessary optical elements are discussed including their potentials and limitations.

**Annotation**
Lecture dates will be fixed in agreement with the students, see institutes website.

A visit at synchrotron ANKA is possible if requested.

**Workload**
lecture times plus assignment to review

**Literature**
M. Born und E. Wolf
Principles of Optics, 7th (expanded) edition
Cambridge University Press, 2010

A. Erko, M. Idir, T. Krist und A. G. Michette
Modern Developments in X-Ray and Neutron Optics
Springer Series in Optical Sciences, Vol. 137
Springer-Verlag Berlin Heidelberg, 2008

D. Attwood
Soft X-Rays and Extreme Ultraviolet Radiation: Principles and Applications
Cambridge University Press, 1999

## T 3.415 Course: ZAK lectures [T-MACH-106376]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102824 - Schlüsselqualifikationen

| Type | Credits | Recurrence | Version |
|---|---|---|---|
| Studienleistung | 2 | Each term | 1 |

**Competence Certificate**
s. course

**Prerequisites**
none

**Annotation**
For details of conception and contents of the courses refer to www.zak.kit.edu/sq

Karlsruher Institut für Technologie

Universität des Landes Baden-Württemberg und
nationales Forschungszentrum in der Helmholtz-Gemeinschaft

# Amtliche Bekanntmachung

**2015** **Ausgegeben Karlsruhe, den 06. August 2015** **Nr. 61**

**I n h a l t** **Seite**

# Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Maschinenbau

**vom 04. August 2015**

Aufgrund von § 10 Absatz 2 Ziff. 5 und § 20 des Gesetzes über das Karlsruher Institut für Technologie (KIT-Gesetz - KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 f), zuletzt geändert durch Artikel 5 des Dritten Gesetzes zur Änderung hochschulrechtlicher Vorschriften (3. Hochschulrechtsänderungsgesetz – 3. HRÄG) vom 01. April 2014 (GBl. S. 99, 167) und § 8 Absatz 5 des Gesetzes über die Hochschulen in Baden-Württemberg (Landeshochschulgesetz - LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 1 des 3. HRÄG vom 01. April 2014 (GBl. S. 99 ff.), hat der Senat des KIT am 20. Juli 2015 die folgende Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 KITG iVm. § 32 Absatz 3 Satz 1 LHG am 04. August 2015 erteilt.

## Inhaltsverzeichnis

**II. Masterprüfung**



**III. Schlussbestimmungen**

## Präambel

Das KIT hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss des Studiums am KIT der Mastergrad stehen soll. Das KIT sieht daher die am KIT angebotenen konsekutiven Bachelor- und Masterstudiengänge als Gesamtkonzept mit konsekutivem Curriculum.

## I. Allgemeine Bestimmungen

### § 1 Geltungsbereich

Diese Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Maschinenbau am KIT.

### § 2 Ziel des Studiums, Akademischer Grad

**(1)** Im konsekutiven Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft, verbreitert, erweitert oder ergänzt werden. Ziel des Studiums ist die Fähigkeit, die wissenschaftlichen Erkenntnisse und Methoden selbstständig anzuwenden und ihre Bedeutung und Reichweite für die Lösung komplexer wissenschaftlicher und gesellschaftlicher Problemstellungen zu bewerten.

**(2)** Aufgrund der bestandenen Masterprüfung wird der akademische Grad „Master of Science (M.Sc.)“ für den Masterstudiengang Maschinenbau verliehen.

### § 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

**(1)** Die Regelstudienzeit beträgt vier Semester.

**(2)** Das Lehrangebot des Studiengangs ist in Fächer, die Fächer sind in Module, die jeweiligen Module in Lehrveranstaltungen gegliedert. Die Fächer und ihr Umfang werden in § 19 festgelegt. Näheres beschreibt das Modulhandbuch.

**(3)** Der für das Absolvieren von Lehrveranstaltungen und Modulen vorgesehene Arbeitsaufwand wird in Leistungspunkten (LP) ausgewiesen. Die Maßstäbe für die Zuordnung von Leistungspunkten entsprechen dem European Credit Transfer System (ECTS). Ein Leistungspunkt entspricht einem Arbeitsaufwand von etwa 30 Zeitstunden. Die Verteilung der Leistungspunkte auf die Semester hat in der Regel gleichmäßig zu erfolgen.

**(4)** Der Umfang der für den erfolgreichen Abschluss des Studiums erforderlichen Studien- und Prüfungsleistungen wird in Leistungspunkten gemessen und beträgt insgesamt 120 Leistungspunkte.

**(5)** Lehrveranstaltungen können nach vorheriger Ankündigung auch in englischer Sprache angeboten werden, sofern es deutschsprachige Wahlmöglichkeiten gibt.

### § 4 Modulprüfungen, Studien- und Prüfungsleistungen

**(1)** Die Masterprüfung besteht aus Modulprüfungen. Modulprüfungen bestehen aus einer oder mehreren Erfolgskontrollen.

Erfolgskontrollen gliedern sich in Studien- oder Prüfungsleistungen.

**(2)** Prüfungsleistungen sind:

1. schriftliche Prüfungen,
2. mündliche Prüfungen oder
3. Prüfungsleistungen anderer Art.

**(3)** Studienleistungen sind schriftliche, mündliche oder praktische Leistungen, die von den Studierenden in der Regel lehrveranstaltungsbegleitend erbracht werden. Die Masterprüfung darf nicht mit einer Studienleistung abgeschlossen werden.

**(4)** Von den Modulprüfungen sollen mindestens 70 % benotet sein.

**(5)** Bei sich ergänzenden Inhalten können die Modulprüfungen mehrerer Module durch eine auch modulübergreifende Prüfungsleistung (Absatz 2 Nr.1 bis 3) ersetzt werden.

### § 5 Anmeldung und Zulassung zu den Modulprüfungen und Lehrveranstaltungen

**(1)** Um an den Modulprüfungen teilnehmen zu können, müssen sich die Studierenden online im Studierendenportal zu den jeweiligen Erfolgskontrollen anmelden. In Ausnahmefällen kann eine Anmeldung schriftlich im Studierendenservice oder in einer anderen vom Studierendenservice autorisierten Einrichtung erfolgen. Für die Erfolgskontrollen können durch die Prüfenden Anmeldefristen festgelegt werden. Die Anmeldung der Masterarbeit ist im Modulhandbuch geregelt.

**(2)** Sofern Wahlmöglichkeiten bestehen, müssen Studierende, um zu einer Prüfung in einem bestimmten Modul zugelassen zu werden, vor der ersten Prüfung in diesem Modul mit der Anmeldung zu der Prüfung eine bindende Erklärung über die Wahl des betreffenden Moduls und dessen Zuordnung zu einem Fach abgeben. Auf Antrag des/der Studierenden an den Prüfungsausschuss kann die Wahl oder die Zuordnung nachträglich geändert werden. Sofern bereits ein Prüfungsverfahren in einem Modul begonnen wurde, ist die Änderung der Wahl oder der Zuordnung erst nach Beendigung des Prüfungsverfahrens zulässig; dies gilt nur für Prüfungsleistungen.

**(3)** Zu einer Erfolgskontrolle ist zuzulassen, wer

1. in den Masterstudiengang Maschinenbau am KIT eingeschrieben ist; die Zulassung beurlaubter Studierender ist auf Prüfungsleistungen beschränkt und

2. nachweist, dass er die im Modulhandbuch für die Zulassung zu einer Erfolgskontrolle festgelegten Voraussetzungen erfüllt und

3. nachweist, dass er in dem Masterstudiengang Maschinenbau den Prüfungsanspruch nicht verloren hat.

**(4)** Nach Maßgabe von § 30 Abs. 5 LHG kann die Zulassung zu einzelnen Pflichtveranstaltungen beschränkt werden. Der/die Prüfende entscheidet über die Auswahl unter den Studierenden, die sich rechtzeitig bis zu dem von dem/der Prüfenden festgesetzten Termin angemeldet haben unter Berücksichtigung des Studienfortschritts dieser Studierenden und unter Beachtung von § 13 Abs. 1 Satz 1 und 2, sofern ein Abbau des Überhangs durch andere oder zusätzliche Veranstaltungen nicht möglich ist. Für den Fall gleichen Studienfortschritts sind durch die KIT-Fakultäten weitere Kriterien festzulegen. Das Ergebnis wird den Studierenden rechtzeitig bekannt gegeben.

**(5)** Die Zulassung ist zu versagen, wenn die in Absatz 3 und 4 genannten Voraussetzungen nicht erfüllt sind. Die Zulassung kann versagt werden, wenn die betreffende Erfolgskontrolle bereits in einem grundständigen Bachelorstudiengang am KIT erbracht wurde, der Zulassungsvoraussetzung für diesen Masterstudiengang gewesen ist. Dies gilt nicht für Mastervorzugsleistungen. Zu diesen ist eine Zulassung nach Maßgabe von Satz 1 ausdrücklich zu genehmigen.

### § 6 Durchführung von Erfolgskontrollen

**(1)** Erfolgskontrollen werden studienbegleitend, in der Regel im Verlauf der Vermittlung der Lehrinhalte der einzelnen Module oder zeitnah danach, durchgeführt.

**(2)** Die Art der Erfolgskontrolle (§ 4 Abs. 2 Nr. 1 bis 3, Abs. 3) wird von der/dem Prüfenden der betreffenden Lehrveranstaltung in Bezug auf die Lerninhalte der Lehrveranstaltung und die Lernziele des Moduls festgelegt. Die Art der Erfolgskontrolle, ihre Häufigkeit, Reihenfolge und Gewichtung sowie gegebenenfalls die Bildung der Modulnote müssen mindestens sechs Wochen vor Vorlesungsbeginn im Modulhandbuch bekannt gemacht werden. Im Einvernehmen von Prüfendem und Studierender bzw. Studierendem können die Art der Prüfungsleistung sowie die Prüfungssprache auch nachträglich geändert werden; im ersten Fall ist jedoch § 4 Abs. 4 zu berücksichtigen. Bei der Prüfungsorganisation sind die Belange Studierender mit Behinderung oder chronischer Erkrankung gemäß § 13 Abs. 1 zu berücksichtigen. § 13 Abs. 1 Satz 3 und 4 gelten entsprechend.

**(3)** Bei unvertretbar hohem Prüfungsaufwand kann eine schriftlich durchzuführende Prüfungsleistung auch mündlich, oder eine mündlich durchzuführende Prüfungsleistung auch schriftlich abgenommen werden. Diese Änderung muss mindestens sechs Wochen vor der Prüfungsleistung bekannt gegeben werden.

**(4)** Bei Lehrveranstaltungen in englischer Sprache (§ 3 Abs. 6) können die entsprechenden Erfolgskontrollen in dieser Sprache abgenommen werden. § 6 Abs. 2 gilt entsprechend.

**(5)** *Schriftliche Prüfungen* (§ 4 Abs. 2 Nr. 1) sind in der Regel von einer/einem Prüfenden nach § 18 Abs. 2 oder 3 zu bewerten. Sofern eine Bewertung durch mehrere Prüfende erfolgt, ergibt sich die Note aus dem arithmetischen Mittel der Einzelbewertungen. Entspricht das arithmetische Mittel keiner der in § 7 Abs. 2 Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe auf- oder abzurunden. Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. Schriftliche Prüfungen dauern mindestens 60 und höchstens 300 Minuten.

**(6)** *Mündliche Prüfungen* (§ 4 Abs. 2 Nr. 2) sind von mehreren Prüfenden (Kollegialprüfung) oder von einer/m Prüfenden in Gegenwart einer oder eines Beisitzenden als Gruppen- oder Einzelprüfungen abzunehmen und zu bewerten. Vor der Festsetzung der Note hört die/der Prüfende die anderen an der Kollegialprüfung mitwirkenden Prüfenden an. Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 60 Minuten pro Studierenden.

Die wesentlichen Gegenstände und Ergebnisse der *mündlichen Prüfung* sind in einem Protokoll festzuhalten. Das Ergebnis der Prüfung ist den Studierenden im Anschluss an die mündliche Prüfung bekannt zu geben.

Studierende, die sich in einem späteren Semester der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen und nach Zustimmung des Prüflings als Zuhörerinnen und Zuhörer bei mündlichen Prüfungen zugelassen. Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse.

**(7)** Für *Prüfungsleistungen anderer Art* (§ 4 Abs. 2 Nr. 3) sind angemessene Bearbeitungsfristen einzuräumen und Abgabetermine festzulegen. Dabei ist durch die Art der Aufgabenstellung und durch entsprechende Dokumentation sicherzustellen, dass die erbrachte Prüfungsleistung dem/der Studierenden zurechenbar ist. Die wesentlichen Gegenstände und Ergebnisse der Erfolgskontrolle sind in einem Protokoll festzuhalten.

Bei *mündlich* durchgeführten *Prüfungsleistungen anderer Art* muss neben der/dem Prüfenden ein/e Beisitzende/r anwesend sein, die/der zusätzlich zum/r Prüfenden das Protokoll zeichnet.

*Schriftliche Arbeiten* im Rahmen einer *Prüfungsleistung anderer Art* haben dabei die folgende Erklärung zu tragen: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde." Trägt die Arbeit diese Erklärung nicht, wird sie nicht angenommen. Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

### § 6 a Erfolgskontrollen im Antwort-Wahl-Verfahren

Das Modulhandbuch regelt, ob und in welchem Umfang Erfolgskontrollen im Wege des *Antwort-Wahl-Verfahrens* abgelegt werden können

**§ 6 b Computergestützte Erfolgskontrollen**

**(1)** Erfolgskontrollen können computergestützt durchgeführt werden. Dabei wird die Antwort bzw. Lösung der/des Studierenden elektronisch übermittelt und, sofern möglich, automatisiert ausgewertet. Die Prüfungsinhalte sind von einer/einem Prüfenden zu erstellen.
**(2)** Vor der computergestützten Erfolgskontrolle hat die/der Prüfende sicherzustellen, dass die elektronischen Daten eindeutig identifiziert und unverwechselbar und dauerhaft den Studierenden zugeordnet werden können. Der störungsfreie Verlauf einer computergestützten Erfolgskontrolle ist durch entsprechende technische Betreuung zu gewährleisten, insbesondere ist die Erfolgskontrolle in Anwesenheit einer fachlich sachkundigen Person durchzuführen. Alle Prüfungsaufgaben müssen während der gesamten Bearbeitungszeit zur Bearbeitung zur Verfügung stehen.

**(3)** Im Übrigen gelten für die Durchführung von computergestützten Erfolgskontrollen die §§ 6 bzw. 6 a.

**§ 7 Bewertung von Studien- und Prüfungsleistungen**

**(1)** Das Ergebnis einer Prüfungsleistung wird von den jeweiligen Prüfenden in Form einer Note festgesetzt.

**(2)** Folgende Noten sollen verwendet werden:

| | | |
|---|---|---|
| sehr gut (very good) | : | hervorragende Leistung, |
| gut (good) | : | eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt, |
| befriedigend (satisfactory) | : | eine Leistung, die durchschnittlichen Anforderungen entspricht, |
| ausreichend (sufficient) | : | eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt, |
| nicht ausreichend (failed) | : | eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt. |

Zur differenzierten Bewertung einzelner Prüfungsleistungen sind nur folgende Noten zugelassen:

| | | |
|---|---|---|
| 1,0; 1,3 | : | sehr gut |
| 1,7; 2,0; 2,3 | : | gut |
| 2,7; 3,0; 3,3 | : | befriedigend |
| 3,7; 4,0 | : | ausreichend |
| 5,0 | : | nicht ausreichend |

**(3)** Studienleistungen werden mit „bestanden“ oder mit „nicht bestanden“ gewertet.

**(4)** Bei der Bildung der gewichteten Durchschnitte der Modulnoten, der Fachnoten und der Gesamtnote wird nur die erste Dezimalstelle hinter dem Komma berücksichtigt; alle weiteren Stellen werden ohne Rundung gestrichen.

**(5)** Jedes Modul und jede Erfolgskontrolle darf in demselben Studiengang nur einmal gewertet werden.

**(6)** Eine Prüfungsleistung ist bestanden, wenn die Note mindestens „ausreichend“ (4,0) ist.

**(7)** Die Modulprüfung ist bestanden, wenn alle erforderlichen Erfolgskontrollen bestanden sind. Die Modulprüfung und die Bildung der Modulnote sollen im Modulhandbuch geregelt werden. Sofern das Modulhandbuch keine Regelung über die Bildung der Modulnote enthält, errechnet sich die Modulnote aus einem nach den Leistungspunkten der einzelnen Teilmodule gewichteter Notendurchschnitt. Die differenzierten Noten (Absatz 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden.

**(8)** Die Ergebnisse der Erfolgskontrollen sowie die erworbenen Leistungspunkte werden durch den Studierendenservice des KIT verwaltet.

**(9)** Die Noten der Module eines Faches gehen in die Fachnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein.

**(10)** Die Gesamtnote der Masterprüfung, die Fachnoten und die Modulnoten lauten:

| | | | | | |
|---|---|---|---|---|---|
| | | bis | 1,5 | = | sehr gut |
| von | 1,6 | bis | 2,5 | = | gut |
| von | 2,6 | bis | 3,5 | = | befriedigend |
| von | 3,6 | bis | 4,0 | = | ausreichend |

**§ 8 Wiederholung von Erfolgskontrollen, endgültiges Nichtbestehen**

**(1)** Studierende können eine nicht bestandene schriftliche Prüfung (§ 4 Absatz 2 Nr. 1) einmal wiederholen. Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ (5,0) bewertet, so findet eine mündliche Nachprüfung im zeitlichen Zusammenhang mit dem Termin der nicht bestandenen Prüfung statt. In diesem Falle kann die Note dieser Prüfung nicht besser als „ausreichend“ (4,0) sein.

**(2)** Studierende können eine nicht bestandene mündliche Prüfung (§ 4 Absatz 2 Nr. 2) einmal wiederholen.

**(3)** Wiederholungsprüfungen nach Absatz 1 und 2 müssen in Inhalt, Umfang und Form (mündlich oder schriftlich) der ersten entsprechen. Ausnahmen kann der zuständige Prüfungsausschuss auf Antrag zulassen.

**(4)** Prüfungsleistungen anderer Art (§ 4 Absatz 2 Nr. 3) können einmal wiederholt werden.

**(5)** Studienleistungen können mehrfach wiederholt werden.

**(6)** Die Wiederholung von Prüfungsleistungen hat spätestens bis zum Ende des Prüfungszeitraumes des übernächsten Semesters zu erfolgen.

**(7)** Die Prüfungsleistung ist endgültig nicht bestanden, wenn die mündliche Nachprüfung im Sinne des Absatzes 1 mit „nicht ausreichend“ (5,0) bewertet wurde. Die Prüfungsleistung ist ferner endgültig nicht bestanden, wenn die mündliche Prüfung im Sinne des Absatzes 2 oder die Prüfungsleistung anderer Art gemäß Absatz 4 zweimal mit „nicht bestanden“ bewertet wurde.

**(8)** Das Modul ist endgültig nicht bestanden, wenn eine für sein Bestehen erforderliche Prüfungsleistung endgültig nicht bestanden ist.

**(9)** Eine zweite Wiederholung derselben Prüfungsleistung gemäß § 4 Abs. 2 ist nur in Ausnahmefällen auf Antrag des/der Studierenden zulässig („Antrag auf Zweitwiederholung“). Der Antrag ist schriftlich beim Prüfungsausschuss in der Regel bis zwei Monate nach Bekanntgabe der Note zu stellen.

Über den ersten Antrag eines/einer Studierenden auf Zweitwiederholung entscheidet der Prüfungsausschuss, wenn er den Antrag genehmigt. Wenn der Prüfungsausschuss diesen Antrag ablehnt, entscheidet ein Mitglied des Präsidiums. Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme des Prüfungsausschusses ein Mitglied des Präsidiums. Wird der Antrag genehmigt, hat die Zweitwiederholung spätestens zum übernächsten Prüfungstermin zu erfolgen. Absatz 1 Satz 2 und 3 gelten entsprechend.

**(10)** Die Wiederholung einer bestandenen Prüfungsleistung ist nicht zulässig.

**(11)** Die Masterarbeit kann bei einer Bewertung mit „nicht ausreichend“ (5,0) einmal wiederholt werden. Eine zweite Wiederholung der Masterarbeit ist ausgeschlossen.

### § 9 Verlust des Prüfungsanspruchs

Ist eine nach dieser Studien- und Prüfungsordnung erforderliche Studien- oder Prüfungsleistung endgültig nicht bestanden oder eine Wiederholungsprüfung nach § 8 Abs. 6 nicht rechtzeitig erbracht oder die Masterprüfung bis zum Ende des Prüfungszeitraums des siebenten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Studiengang Maschinenbau, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist. Die Entscheidung über eine Fristverlängerung und über Ausnahmen von der Fristregelung trifft der Prüfungsausschuss unter Beachtung der in § 32 Abs. 6 LHG genannten Tätigkeiten auf Antrag des/der Studierenden. Der Antrag ist schriftlich in der Regel bis sechs Wochen vor Ablauf der Frist zu stellen.

### § 10 Abmeldung; Versäumnis, Rücktritt

**(1)** Studierende können ihre Anmeldung zu *schriftlichen Prüfungen* ohne Angabe von Gründen bis zur Ausgabe der Prüfungsaufgaben widerrufen (Abmeldung). Eine Abmeldung kann online im Studierendenportal bis 24:00 Uhr des Vortages der Prüfung oder in begründeten Ausnahmefällen beim Studierendenservice innerhalb der Geschäftszeiten erfolgen. Erfolgt die Abmeldung gegenüber dem/der Prüfenden hat diese/r Sorge zu tragen, dass die Abmeldung im Campus Management System verbucht wird.

**(2)** Bei *mündlichen Prüfungen* muss die Abmeldung spätestens drei Werktage vor dem betreffenden Prüfungstermin gegenüber dem/der Prüfenden erklärt werden. Der Rücktritt von einer mündlichen Prüfung weniger als drei Werktage vor dem betreffenden Prüfungstermin ist nur unter den Voraussetzungen des Absatzes 5 möglich. Der Rücktritt von mündlichen Nachprüfungen im Sinne von § 9 Abs. 1 ist grundsätzlich nur unter den Voraussetzungen von Absatz 5 möglich.

**(3)** Die Abmeldung von *Prüfungsleistungen anderer Art* sowie von *Studienleistungen* ist im Modulhandbuch geregelt.

**(4)** Eine Erfolgskontrolle gilt als mit „nicht ausreichend“ (5,0) bewertet, wenn die Studierenden einen Prüfungstermin ohne triftigen Grund versäumen oder wenn sie nach Beginn der Erfolgskontrolle ohne triftigen Grund von dieser zurücktreten. Dasselbe gilt, wenn die Masterarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, der/die Studierende hat die Fristüberschreitung nicht zu vertreten.

**(5)** Der für den Rücktritt nach Beginn der Erfolgskontrolle oder das Versäumnis geltend gemachte Grund muss dem Prüfungsausschuss unverzüglich schriftlich angezeigt und glaubhaft gemacht werden. Bei Krankheit des/der Studierenden oder eines allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann die Vorlage eines ärztlichen Attestes verlangt werden.

### § 11 Täuschung, Ordnungsverstoß

**(1)** Versuchen Studierende das Ergebnis ihrer Erfolgskontrolle durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet.

**(2)** Studierende, die den ordnungsgemäßen Ablauf einer Erfolgskontrolle stören, können von der/dem Prüfenden oder der Aufsicht führenden Person von der Fortsetzung der Erfolgskontrolle ausgeschlossen werden. In diesem Fall gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet. In schwerwiegenden Fällen kann der Prüfungsausschuss diese Studierenden von der Erbringung weiterer Erfolgskontrollen ausschließen.

**(3)** Näheres regelt die Allgemeine Satzung des KIT zur Redlichkeit bei Prüfungen und Praktika in der jeweils gültigen Fassung.

### § 12 Mutterschutz, Elternzeit, Wahrnehmung von Familienpflichten

**(1)** Auf Antrag sind die Mutterschutzfristen, wie sie im jeweils gültigen Gesetz zum Schutz der erwerbstätigen Mutter (Mutterschutzgesetz - MuSchG) festgelegt sind, entsprechend zu berücksichtigen. Dem Antrag sind die erforderlichen Nachweise beizufügen. Die Mutterschutzfristen unterbrechen jede Frist nach dieser Prüfungsordnung. Die Dauer des Mutterschutzes wird nicht in die Frist eingerechnet.

**(2)** Gleichfalls sind die Fristen der Elternzeit nach Maßgabe des jeweils gültigen Gesetzes (Bundeselterngeld- und Elternzeitgesetz - BEEG) auf Antrag zu berücksichtigen. Der/die Studierende muss bis spätestens vier Wochen vor dem Zeitpunkt, von dem an die Elternzeit angetreten werden soll, dem Prüfungsausschuss, unter Beifügung der erforderlichen Nachweise schriftlich mitteilen, in welchem Zeitraum die Elternzeit in Anspruch genommen werden soll. Der Prüfungsausschuss hat zu prüfen, ob die gesetzlichen Voraussetzungen vorliegen, die bei einer Arbeitnehmerin bzw. einem Arbeitnehmer den Anspruch auf Elternzeit auslösen würden, und teilt dem/der Studierenden das Ergebnis sowie die neu festgesetzten Prüfungszeiten unverzüglich mit. Die Bearbeitungszeit der Masterarbeit kann nicht durch Elternzeit unterbrochen werden. Die gestellte Arbeit gilt als nicht vergeben. Nach Ablauf der Elternzeit erhält der/die Studierende ein neues Thema, das innerhalb der in § 14 festgelegten Bearbeitungszeit zu bearbeiten ist.

**(3)** Der Prüfungsausschuss entscheidet auf Antrag über die flexible Handhabung von Prüfungsfristen entsprechend den Bestimmungen des Landeshochschulgesetzes, wenn Studierende Familienpflichten wahrzunehmen haben. Absatz 2 Satz 4 bis 6 gelten entsprechend.

### § 13 Studierende mit Behinderung oder chronischer Erkrankung

**(1)** Bei der Gestaltung und Organisation des Studiums sowie der Prüfungen sind die Belange von Studierenden mit Behinderung oder chronischer Erkrankung zu berücksichtigen. Insbesondere ist Studierenden mit Behinderung oder chronischer Erkrankung bevorzugter Zugang zu teilnahmebegrenzten Lehrveranstaltungen zu gewähren und die Reihenfolge für das Absolvieren bestimmter Lehrveranstaltungen entsprechend ihrer Bedürfnisse anzupassen. Studierende sind gemäß Bundesgleichstellungsgesetz (BGG) und Sozialgesetzbuch Neuntes Buch (SGB IX) behindert, wenn ihre körperliche Funktion, geistige Fähigkeit oder seelische Gesundheit mit hoher Wahrscheinlichkeit länger als sechs Monate von dem für das Lebensalter typischen Zustand abweichen und daher ihre Teilhabe am Leben in der Gesellschaft beeinträchtigt ist. Der Prüfungsausschuss entscheidet auf Antrag der/des Studierenden über das Vorliegen der Voraussetzungen nach Satz 2 und 3. Die/der Studierende hat die entsprechenden Nachweise vorzulegen.

**(2)** Weisen Studierende eine Behinderung oder chronische Erkrankung nach und folgt daraus, dass sie nicht in der Lage sind, Erfolgskontrollen ganz oder teilweise in der vorgeschriebenen Zeit oder Form abzulegen, kann der Prüfungsausschuss gestatten, die Erfolgskontrollen in einem anderen Zeitraum oder einer anderen Form zu erbringen. Insbesondere ist behinderten Studierenden zu gestatten, notwendige Hilfsmittel zu benutzen.

**(3)** Weisen Studierende eine Behinderung oder chronische Erkrankung nach und folgt daraus, dass sie nicht in der Lage sind, die Lehrveranstaltungen regelmäßig zu besuchen oder die gemäß § 19 erforderlichen Studien- und Prüfungsleistungen zu erbringen, kann der Prüfungsausschuss auf Antrag gestatten, dass einzelne Studien- und Prüfungsleistungen nach Ablauf der in dieser Studien- und Prüfungsordnung vorgesehenen Fristen absolviert werden können.

**§ 14 Modul Masterarbeit**

**(1)** Voraussetzung für die Zulassung zum Modul Masterarbeit ist, dass die/der Studierende Modulprüfungen im Umfang von 74 LP erfolgreich abgelegt hat. Über Ausnahmen entscheidet der Prüfungsausschuss auf Antrag der/des Studierenden.

**(1 a)** Dem Modul Masterarbeit sind 30 LP zugeordnet. Es besteht aus der Masterarbeit und einer Präsentation. Die Präsentation hat spätestens sechs Wochen nach Abgabe der Masterarbeit zu erfolgen.

**(2)** Die Masterarbeit kann von Hochschullehrer/innen und leitenden Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG vergeben werden. Darüber hinaus kann der Prüfungsausschuss weitere Prüfende gemäß § 17 Abs. 2 und 3 zur Vergabe des Themas berechtigen. Den Studierenden ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. Soll die Masterarbeit außerhalb der KIT-Fakultät für Maschinenbau angefertigt werden, so bedarf dies der Genehmigung durch den Prüfungsausschuss. Die Masterarbeit kann auch in Form einer Gruppenarbeit zugelassen werden, wenn der als Prüfungsleistung zu bewertende Beitrag der einzelnen Studierenden aufgrund objektiver Kriterien, die eine eindeutige Abgrenzung ermöglichen, deutlich unterscheidbar ist und die Anforderung nach Absatz 4 erfüllt. In Ausnahmefällen sorgt die/der Vorsitzende des Prüfungsausschusses auf Antrag der oder des Studierenden dafür, dass die/der Studierende innerhalb von vier Wochen ein Thema für die Masterarbeit erhält. Die Ausgabe des Themas erfolgt in diesem Fall über die/den Vorsitzende/n des Prüfungsausschusses.

**(3)** Thema, Aufgabenstellung und Umfang der Masterarbeit sind von dem Betreuer bzw. der Betreuerin so zu begrenzen, dass sie mit dem in Absatz 4 festgelegten Arbeitsaufwand bearbeitet werden kann.

**(4)** Die Masterarbeit soll zeigen, dass die Studierenden in der Lage sind, ein Problem aus ihrem Studienfach selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden zu bearbeiten. Der Umfang der Masterarbeit entspricht 30 Leistungspunkten. Die maximale Bearbeitungsdauer beträgt sechs Monate. Thema und Aufgabenstellung sind an den vorgesehenen Umfang anzupassen. Der Prüfungsausschuss legt fest, in welchen Sprachen die Masterarbeit geschrieben werden kann. Auf Antrag des Studierenden kann der/die Prüfende genehmigen, dass die Masterarbeit in einer anderen Sprache als Deutsch geschrieben wird.

**(5)** Bei der Abgabe der Masterarbeit haben die Studierenden schriftlich zu versichern, dass sie die Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt haben, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet haben. Wenn diese Erklärung nicht enthalten ist, wird die Arbeit nicht angenommen. Die Erklärung kann wie folgt lauten: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig verfasst, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben.“ Bei Abgabe einer unwahren Versicherung wird die Masterarbeit mit „nicht ausreichend“ (5,0) bewertet.

**(6)** Der Zeitpunkt der Ausgabe des Themas der Masterarbeit ist durch die Betreuerin/den Betreuer und die/den Studierenden festzuhalten und dies beim Prüfungsausschuss aktenkundig zu machen. Der Zeitpunkt der Abgabe der Masterarbeit ist durch den/die Prüfende/n beim Prüfungsausschuss aktenkundig zu machen. Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. Macht der oder die Studierende einen triftigen Grund geltend, kann der Prüfungsausschuss die in Absatz 4 festgelegte Bearbeitungszeit auf Antrag der oder des Studierenden um höchstens drei Monate verlängern. Wird die Masterarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend“ (5,0) bewertet, es sei denn, dass die Studierenden dieses Versäumnis nicht zu vertreten haben.

**(7)** Die Masterarbeit wird von mindestens einem/einer Hochschullehrer/in oder einem/einer leitenden Wissenschaftler/in gemäß § 14 abs. 3 Ziff. 1 KITG und einem/einer weiteren Prüfenden bewertet. In der Regel ist eine/r der Prüfenden die Person, die die Arbeit gemäß Absatz 2 vergeben hat. Bei nicht übereinstimmender Beurteilung dieser beiden Personen setzt der Prüfungsausschuss im Rahmen der Bewertung dieser beiden Personen die Note der Masterarbeit fest; er kann auch einen weiteren Gutachter bestellen. Die Bewertung hat innerhalb von sechs Wochen nach Abgabe der Masterarbeit zu erfolgen.

### § 15 Zusatzleistungen

**(1)** Es können auch weitere Leistungspunkte (Zusatzleistungen) im Umfang von höchstens 30 LP aus dem Gesamtangebot des KIT erworben werden. § 3 und § 4 der Prüfungsordnung bleiben davon unberührt. Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt- und Modulnoten ein. Die bei der Festlegung der Modulnote nicht berücksichtigten LP werden als Zusatzleistungen im Transcript of Records aufgeführt und als Zusatzleistungen gekennzeichnet. Auf Antrag der/des Studierenden werden die Zusatzleistungen in das Masterzeugnis aufgenommen und als Zusatzleistungen gekennzeichnet. Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet.

**(2)** Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

### § 16 Prüfungsausschuss

**(1)** Für den Masterstudiengang Maschinenbau wird ein Prüfungsausschuss gebildet. Er besteht aus vier stimmberechtigten Mitgliedern: zwei Hochschullehrer/innen / leitenden Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG / Privatdozentinnen bzw. -dozenten, zwei akademischen Mitarbeiterinnen und Mitarbeitern nach § 52 LHG / wissenschaftlichen Mitarbeiter/innen gemäß § 14 Abs. 3 Ziff. 2 KITG und einer bzw. einem Studierenden mit beratender Stimme. Im Falle der Einrichtung eines gemeinsamen Prüfungsausschusses für den Bachelor- und den Masterstudiengang Maschinenbau erhöht sich die Anzahl der Studierenden auf zwei Mitglieder mit beratender Stimme, wobei je eine bzw. einer dieser beiden aus dem Bachelor- und aus dem Masterstudiengang stammt. Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

**(2)** Die/der Vorsitzende, ihre/sein Stellvertreter/in, die weiteren Mitglieder des Prüfungsausschusses sowie deren Stellvertreter/innen werden von dem KIT-Fakultätsrat bestellt, die akademischen Mitarbeiter/innen nach § 52 LHG, die wissenschaftlichen Mitarbeiter gemäß § 14 Abs. 3 Ziff. 2 KITG und die Studierenden auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. Die/der Vorsitzende und deren/dessen Stellvertreter/in müssen Hochschullehrer/innen oder leitende Wissenschaftler/innen § 14 Abs. 3 Ziff. 1 KITG sein. Die/der Vorsitzende des Prüfungsausschusses nimmt die laufenden Geschäfte wahr und wird durch das jeweilige Prüfungssekretariat unterstützt.

**(3)** Der Prüfungsausschuss achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung und fällt die Entscheidungen in Prüfungsangelegenheiten. Er entscheidet über die Anerkennung von Studienzeiten sowie Studien- und Prüfungsleistungen und trifft die Feststellung gemäß § 18 Absatz 1 Satz 1. Er berichtet der KIT-Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Masterarbeiten und die Verteilung der Modul- und Gesamtnoten. Er ist zuständig für Anregungen zur Reform der Studien- und Prüfungsordnung und zu Modulbeschreibungen. Der Prüfungsausschuss entscheidet mit der Mehrheit seiner Stimmen. Bei Stimmengleichheit entscheidet der Vorsitzende des Prüfungsausschusses.

**(4)** Der Prüfungsausschuss kann die Erledigung seiner Aufgaben für alle Regelfälle auf die/den Vorsitzende/n des Prüfungsausschusses übertragen. In dringenden Angelegenheiten, deren Erledigung nicht bis zu der nächsten Sitzung des Prüfungsausschusses warten kann, entscheidet die/der Vorsitzende des Prüfungsausschusses.

**(5)** Die Mitglieder des Prüfungsausschusses haben das Recht, der Abnahme von Prüfungen beizuwohnen. Die Mitglieder des Prüfungsausschusses, die Prüfenden und die Beisitzenden unterliegen der Verschwiegenheit. Sofern sie nicht im öffentlichen Dienst stehen, sind sie durch die/den Vorsitzende/n zur Verschwiegenheit zu verpflichten.

**(6)** In Angelegenheiten des Prüfungsausschusses, die eine an einer anderen KIT-Fakultät zu absolvierende Prüfungsleistung betreffen, ist auf Antrag eines Mitgliedes des Prüfungsausschusses eine fachlich zuständige und von der betroffenen KIT-Fakultät zu nennende prüfungsberechtigte Person hinzuzuziehen.

**(7)** Belastende Entscheidungen des Prüfungsausschusses sind schriftlich mitzuteilen. Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben. Widersprüche gegen Entscheidungen des Prüfungsausschusses sind innerhalb eines Monats nach Zugang der Entscheidung schriftlich oder zur Niederschrift beim Präsidium des KIT einzulegen.

### § 17 Prüfende und Beisitzende

**(1)** Der Prüfungsausschuss bestellt die Prüfenden. Er kann die Bestellung der/dem Vorsitzenden übertragen.

**(2)** Prüfende sind Hochschullehrer/innen sowie leitende Wissenschaftler/innen gemäß § 14 Abs. 3 Ziff. 1 KITG, habilitierte Mitglieder und akademische Mitarbeiter/innen gemäß § 52 LHG, welche der KIT-Fakultät angehören und denen die Prüfungsbefugnis übertragen wurde; desgleichen kann wissenschaftlichen Mitarbeitern gemäß § 14 Abs. 3 Ziff. 2 KITG die Prüfungsbefugnis übertragen werden. Bestellt werden darf nur, wer mindestens die dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat.

**(3)** Soweit Lehrveranstaltungen von anderen als den unter Absatz 2 genannten Personen durchgeführt werden, sollen diese zu Prüfenden bestellt werden, sofern die KIT-Fakultät eine Prüfungsbefugnis erteilt hat und sie die gemäß Absatz 2 Satz 2 vorausgesetzte Qualifikation nachweisen können.

**(4)** Die Beisitzenden werden durch die Prüfenden benannt. Zu Beisitzenden darf nur bestellt werden, wer einen akademischen Abschluss in einem mathematisch-naturwissenschaftlichen oder ingenieurwissenschaftlichen Studiengang oder einen gleichwertigen akademischen Abschluss erworben hat.

### § 18 Anerkennung von Studien- und Prüfungsleistungen, Studienzeiten

**(1)** Studien- und Prüfungsleistungen sowie Studienzeiten, die in Studiengängen an staatlichen oder staatlich anerkannten Hochschulen und Berufsakademien der Bundesrepublik Deutschland oder an ausländischen staatlichen oder staatlich anerkannten Hochschulen erbracht wurden, werden auf Antrag der Studierenden anerkannt, sofern hinsichtlich der erworbenen Kompetenzen kein wesentlicher Unterschied zu den Leistungen oder Abschlüssen besteht, die ersetzt werden sollen. Dabei ist kein schematischer Vergleich, sondern eine Gesamtbetrachtung vorzunehmen. Bezüglich des Umfangs einer zur Anerkennung vorgelegten Studienleistung bzw. Prüfungsleistung (Anrechnung) werden die Grundsätze des ECTS herangezogen.

**(2)** Die Studierenden haben die für die Anerkennung erforderlichen Unterlagen vorzulegen. Studierende, die neu in den Masterstudiengang Maschinenbau immatrikuliert wurden, haben den Antrag mit den für die Anerkennung erforderlichen Unterlagen innerhalb eines Semesters nach Immatrikulation zu stellen. Bei Unterlagen, die nicht in deutscher oder englischer Sprache vorliegen, kann eine amtlich beglaubigte Übersetzung verlangt werden. Die Beweislast dafür, dass der Antrag die Voraussetzungen für die Anerkennung nicht erfüllt, liegt beim Prüfungsausschuss.

**(3)** Werden Leistungen angerechnet, die nicht am KIT erbracht wurden, werden sie im Zeugnis als „anerkannt“ ausgewiesen. Liegen Noten vor, werden die Noten, soweit die Notensysteme vergleichbar sind, übernommen und in die Berechnung der Modulnoten und der Gesamtnote einbezogen. Sind die Notensysteme nicht vergleichbar, können die Noten umgerechnet werden. Liegen keine Noten vor, wird der Vermerk „bestanden“ aufgenommen.

**(4)** Bei der Anerkennung von Studien- und Prüfungsleistungen, die außerhalb der Bundesrepublik Deutschland erbracht wurden, sind die von der Kultusministerkonferenz und der Hochschulrektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpartnerschaften zu beachten.

**(5)** Außerhalb des Hochschulsystems erworbene Kenntnisse und Fähigkeiten werden angerechnet, wenn sie nach Inhalt und Niveau den Studien- und Prüfungsleistungen gleichwertig sind, die ersetzt werden sollen und die Institution, in der die Kenntnisse und Fähigkeiten erworben wurden, ein genormtes Qualitätssicherungssystem hat. Die Anrechnung kann in Teilen versagt werden, wenn mehr als 50 Prozent des Hochschulstudiums ersetzt werden soll.

**(6)** Zuständig für Anerkennung und Anrechnung ist der Prüfungsausschuss. Im Rahmen der Feststellung, ob ein wesentlicher Unterschied im Sinne des Absatz 1 vorliegt, sind die zuständigen Fachvertreter/innen zu hören. Der Prüfungsausschuss entscheidet in Abhängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

## II. Masterprüfung

### § 19 Umfang und Art der Masterprüfung

**(1)** Die Masterprüfung besteht aus den Modulprüfungen nach Absatz 2 und 3 sowie der Modul Masterarbeit (§ 14).

**(2)** Es sind Modulprüfungen im Pflichtfach „Vertiefung ingenieurwissenschaftlicher Grundlagen" im Umfang von 50 LP abzulegen.

Die Festlegung der zur Auswahl stehenden Module wird im Modulhandbuch getroffen.

**(3)** Im Wahlpflichtbereich ist ein Wahlpflichtfach im Umfang von 40 LP zu absolvieren. Zur Auswahl steht mindestens das Fach „Allgemeiner Maschinenbau". Die Festlegung der weiteren zur Auswahl stehenden Fächer und der den Fächern zugeordneten Module wird im Modulhandbuch getroffen.

### § 20 Bestehen der Masterprüfung, Bildung der Gesamtnote

**(1)** Die Masterprüfung ist bestanden, wenn alle in § 19 genannten Modulprüfungen mindestens mit „ausreichend" bewertet wurden.

**(2)** Die Gesamtnote der Masterprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt der Fachnoten und dem Modul Masterarbeit.

**(3)** Haben Studierende die Masterarbeit mit der Note 1,0 und die Masterprüfung mit einem Durchschnitt von 1,2 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung" (with distinction) verliehen.

### § 21 Masterzeugnis, Masterurkunde, Diploma Supplement und Transcript of Records

**(1)** Über die Masterprüfung werden nach Bewertung der letzten Prüfungsleistung eine Masterurkunde und ein Zeugnis erstellt. Die Ausfertigung von Masterurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen der letzten Prüfungsleistung erfolgen. Masterurkunde und Masterzeugnis werden in deutscher und englischer Sprache ausgestellt. Masterurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. Diese Dokumente werden den Studierenden zusammen ausgehändigt. In der Masterurkunde wird die Verleihung des akademischen Mastergrades beurkundet. Die Masterurkunde wird von dem Präsidenten und der KIT-Dekanin/ dem KIT-Dekan der KIT-Fakultät unterzeichnet und mit dem Siegel des KIT versehen.

**(2)** Das Zeugnis enthält die Fach- und Modulnoten sowie die den Modulen und Fächern zugeordnete Leistungspunkte und die Gesamtnote. Sofern gemäß § 7 Abs. 2 Satz 2 eine differenzierte Bewertung einzelner Prüfungsleitungen vorgenommen wurde, wird auf dem Zeugnis auch die entsprechende Dezimalnote ausgewiesen; § 7 Abs. 4 bleibt unberührt. Das Zeugnis ist von der KIT-Dekanin/ dem KIT-Dekan der KIT-Fakultät und von der/dem Vorsitzenden des Prüfungsausschusses zu unterzeichnen.

**(3)** Mit dem Zeugnis erhalten die Studierenden ein Diploma Supplement in deutscher und englischer Sprache, das den Vorgaben des jeweils gültigen ECTS Users‘ Guide entspricht, sowie ein Transcript of Records in deutscher und englischer Sprache.

**(4)** Das Transcript of Records enthält in strukturierter Form alle erbrachten Studien- und Prüfungsleistungen. Dies beinhaltet alle Fächer und Fachnoten samt den zugeordneten Leistungspunkten, die dem jeweiligen Fach zugeordneten Module mit den Modulnoten und zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Erfolgskontrollen samt Noten und zugeordneten Leistungspunkten. Absatz 2 Satz 2 gilt entsprechend. Aus dem Transcript of Records soll die Zugehörigkeit von Lehrveranstaltungen zu den einzelnen Modulen deutlich erkennbar sein. Angerechnete Studien- und Prüfungsleistungen sind im Transcript of Records aufzunehmen. Alle Zusatzleistungen werden im Transcript of Records aufgeführt.

**(5)** Die Masterurkunde, das Masterzeugnis und das Diploma Supplement, einschließlich des Transcript of Records, werden vom Studierendenservice des KIT ausgestellt.

## III. Schlussbestimmungen

### § 22 Bescheinigung von Prüfungsleistungen

Haben Studierende die Masterprüfung endgültig nicht bestanden, wird ihnen auf Antrag und gegen Vorlage der Exmatrikulationsbescheinigung eine schriftliche Bescheinigung ausgestellt, die die erbrachten Studien- und Prüfungsleistungen und deren Noten enthält und erkennen lässt, dass die Prüfung insgesamt nicht bestanden ist. Dasselbe gilt, wenn der Prüfungsanspruch erloschen ist.

### § 23 Aberkennung des Mastergrades

**(1)** Haben Studierende bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei denen getäuscht wurde, berichtigt werden. Gegebenenfalls kann die Modulprüfung für „nicht ausreichend“ (5,0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

**(2)** Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass die/der Studierende darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. Hat die/der Studierende die Zulassung vorsätzlich zu Unrecht erwirkt, so kann die Modulprüfung für „nicht ausreichend“ (5,0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

**(3)** Vor einer Entscheidung des Prüfungsausschusses ist Gelegenheit zur Äußerung zu geben.

**(4)** Das unrichtige Zeugnis ist zu entziehen und gegebenenfalls ein neues zu erteilen. Mit dem unrichtigen Zeugnis ist auch die Masterurkunde einzuziehen, wenn die Masterprüfung aufgrund einer Täuschung für „nicht bestanden“ erklärt wurde.

**(5)** Eine Entscheidung nach Absatz 1 und Absatz 2 Satz 2 ist nach einer Frist von fünf Jahren ab dem Datum des Zeugnisses ausgeschlossen.

**(6)** Die Aberkennung des akademischen Grades richtet sich nach § 36 Abs. 7 LHG.

**§ 24 Einsicht in die Prüfungsakten**

**(1)** Nach Abschluss der Masterprüfung wird den Studierenden auf Antrag innerhalb eines Jahres Einsicht in das Prüfungsexemplar ihrer Masterarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

**(2)** Für die Einsichtnahme in die schriftlichen Modulprüfungen, schriftlichen Modulteilprüfungen bzw. Prüfungsprotokolle gilt eine Frist von einem Monat nach Bekanntgabe des Prüfungsergebnisses.

**(3)** Der/die Prüfende bestimmt Ort und Zeit der Einsichtnahme.

**(4)** Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

**§ 25 Inkrafttreten, Übergangsvorschriften**

**(1)** Diese Studien- und Prüfungsordnung tritt am 01. Oktober 2016 in Kraft.

**(2)** Gleichzeitig tritt die Studien- und Prüfungsordnung des KIT für den Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), außer Kraft.

**(3)** Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können Prüfungen auf Grundlage dieser Studien- und Prüfungsordnung letztmalig am 30. September 2020 ablegen.

**(4)** Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau vom 28. Februar 2008 (Amtliche Bekanntmachung des KIT Nr. 79 vom 09. September 2008), zuletzt geändert durch Satzung vom 24. September 2014 (Amtliche Bekanntmachung des KIT Nr. 54 vom 01. Oktober 2014), ihr Studium am KIT aufgenommen haben, können auf Antrag ihr Studium nach der vorliegenden Studien- und Prüfungsordnung fortsetzen.

**(5)** Die Prüfungsordnung für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 18 vom 15. August 2000, S. 107 ff.) bleibt außer Kraft. Studierende, die auf Grundlage der Prüfungsordnung für den Diplomstudiengang Maschinenbau vom 27. Juli 2000 (Amtliche Bekanntmachung der Universität Karlsruhe (TH) Nr. 18 vom 15. August 2000, S. 107 ff.) ihr Studium an der Universität Karlsruhe (TH) aufgenommen haben, können die Diplomprüfung einschließlich etwaiger Wiederholungen letztmalig bis zum 30. September 2017 ablegen.

Karlsruhe, den 04. August 2015

*Professor Dr.-Ing. Holger Hanselka*
*(Präsident)*

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

# Amtliche Bekanntmachung

**2019** **Ausgegeben Karlsruhe, den 26. Februar 2019** **Nr. 04**

**I n h a l t** **Seite**

**Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Maschinenbau**

vom 21. Februar 2019

Aufgrund von § 10 Absatz 2 Ziff. 5 und § 20 Absatz 2 Satz 1 des Gesetzes über das Karlsruher Institut für Technologie (KIT-Gesetz - KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 f), zuletzt geändert durch Artikel 2 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85, 94), und § 32 Absatz 3 Satz 1 des Gesetzes über die Hochschulen in Baden-Württemberg (Landeshochschulgesetz - LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 1 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl. S. 85) hat der KIT-Senat am 18. Februar 2019 die folgende Satzung zur Änderung der Studien- und Prüfungsordnung für den Masterstudiengang Maschinenbau vom 04. August 2015 (Amtliche Bekanntmachung des Karlsruher Instituts für Technologie (KIT) Nr. 61 vom 06. August 2015) beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 Satz 1 KITG i.V.m. § 32 Absatz 3 Satz 1 LHG am 21. Februar 2019 erteilt.

**Artikel 1 – Änderung der Studien- und Prüfungsordnung**

**1. § 12 Absatz 1 wird wie folgt geändert:**

a) Satz 1 wird wie folgt gefasst:

„Es gelten die Vorschriften des Gesetzes zum Schutz von Müttern bei der Arbeit, in der Ausbildung und im Studium (Mutterschutzgesetz – MuSchG) in seiner jeweils geltenden Fassung."

b) Satz 2 wird aufgehoben.

c) Die bisherigen Sätze 3 und 4 werden die Sätze 2 und 3

**2. § 14 wird wie folgt geändert:**

a) In Absatz 2 Satz 1 werden nach den Wörtern „Hochschullehrer/innen" das Wort "und" durch ein Komma ersetzt und nach der Angabe „§ 14 Abs. 3 Ziff. 1 KITG" die Wörter „und habilitierten Mitgliedern der KIT-Fakultät für Maschinenbau" eingefügt.

b) In Absatz 7 Satz 1 werden nach den Wörtern „Hochschullehrer/innen" das Wort "oder" durch ein Komma ersetzt und nach der Angabe „§ 14 abs. 3 Ziff. 1 KITG" die Wörter „oder einem habilitierten Mitglied der KIT-Fakultät für Maschinenbau" eingefügt.

**3. § 16 wird wie folgt geändert:**

a) In Absatz 1 Satz 3 wird das Wort „stammt" durch die Wörter „stammen soll" ersetzt.

b) In Absatz 7 Satz 4 werden nach dem Wort „Entscheidung" die Wörter „schriftlich oder zur Niederschrift" gestrichen.

**4. § 17 Absatz 3 wird wie folgt geändert:**

Nach dem Wort „sofern“ werden die Wörter „die KIT-Fakultät eine Prüfungsbefugnis erteilt hat und“ gestrichen.

**Artikel 2 – Inkrafttreten**

Diese Änderungssatzung tritt zum 01. April 2019 in Kraft.

Karlsruhe, den 21. Februar 2019

*gez. Prof. Dr.-Ing. Holger Hanselka*
*(Präsident)*

Karlsruher Institut für Technologie

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

# Amtliche Bekanntmachung

**2017** **Ausgegeben Karlsruhe, den 24. November 2017** **Nr. 68**

**I n h a l t** **Seite**

## Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT)

vom 22. November 2017

Aufgrund von § 10 Abs. 2 Ziff. 6 und § 20 des KIT-Gesetzes (KITG), zuletzt geändert durch Artikel 4 des Gesetzes zur Änderung des Landeshochschulgebührengesetzes und anderer Gesetze vom 09. Mai 2017 (GBl. S. 245, 250), §§ 59 Abs. 1, 63 Abs. 2 des Landeshochschulgesetzes (LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 f), zuletzt geändert durch Artikel 3 des Gesetzes zur Änderung des Landeshochschulgebührengesetzes und anderer Gesetze vom 09. Mai 2017 (GBl. S. 245, 250), hat der KIT-Senat in seiner Sitzung am 20. November 2017 die nachstehende Satzung beschlossen.

### § 1 Anwendungsbereich

Die Satzung regelt den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (im Folgenden: KIT).

### § 2 Fristen

(1) Eine Immatrikulation erfolgt sowohl zum Winter- als auch zum Sommersemester.

(2) Der Antrag auf Immatrikulation einschließlich aller erforderlichen Unterlagen muss

- für das **Wintersemester** bis zum **30. September eines Jahres**
- für das **Sommersemester** bis zum **31. März eines Jahres**

beim KIT eingegangen sein.

### § 3 Form des Antrages

(1) Die Form des Antrags richtet sich nach den allgemeinen für das Zulassungs- und Immatrikulationsverfahren geltenden Bestimmungen in der jeweils gültigen Zulassungs- und Immatrikulationsordnung des KIT.

(2) Dem Antrag sind folgende Unterlagen beizufügen:

1. eine Kopie des Nachweises über den Bachelorabschluss oder gleichwertigen Abschluss gemäß § 5 Abs. 1 Nr. 1 samt Diploma Supplement und Transcript of Records (unter Angabe der erbrachten Leistungspunkte/ECTS),
2. Nachweise der in § 5 Abs. 1 Nr. 3 genannten Mindestkenntnisse und Mindestleistungen, aus denen die Lernziele, Studieninhalte und Leistungspunkte hervorgehen, ggfs. Nachweis einer erfolgreichen Aufnahmeprüfung gemäß § 7 Abs. 2,
3. ein Nachweis über ein mindestens 18-wöchiges Berufspraktikum, welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde (§ 6),
4. eine schriftliche Erklärung der/des Bewerber/in darüber, ob sie/er in dem Masterstudiengang Maschinenbau oder einem verwandten Studiengang mit im Wesentlichen gleichem

Inhalt gemäß § 5 Abs. 2 eine nach der Prüfungsordnung erforderliche Prüfung endgültig nicht bestanden hat oder der Prüfungsanspruch aus sonstigen Gründen nicht mehr besteht,

5. Nachweise über die in § 5 Abs. 1 Nr. 5 a) oder b) genannten Sprachkenntnisse,

6. die in der jeweils gültigen Zulassungs- und Immatrikulationsordnung genannten weiteren Unterlagen.

Das KIT kann verlangen, dass diese der Zugangsentscheidung zugrundeliegenden Dokumente bei der Einschreibung im Original vorzulegen sind.

(3) Die Immatrikulation in den Masterstudiengang Maschinenbau kann auch beantragt werden, wenn bis zum Ablauf der Bewerbungsfrist im Sinne des § 2 der Bachelorabschluss noch nicht vorliegt und aufgrund des bisherigen Studienverlaufs, insbesondere der bisherigen Studien- und Prüfungsleistungen zu erwarten ist, dass die/der Bewerber/in das Bachelorstudium rechtzeitig vor Beginn des Masterstudiengangs Maschinenbau abschließt.

In diesem Fall sind die bis zu diesem Zeitpunkt erbrachten Studien- und Prüfungsleistungen im Rahmen der Zugangsentscheidung zu berücksichtigen. Das spätere Ergebnis des Bachelorabschlusses bleibt unbeachtet. Der Bewerbung ist

a) eine Bescheinigung über die bis zum Ende der Bewerbungsfrist erbrachten Prüfungsleistungen (z.B. Notenauszug) sowie

b) eine Übersicht aller noch nicht nachgewiesenen Prüfungs- und Studienleistungen mit Angabe des Prüfungsdatums und des Nachweises der Prüfungsanmeldung beizulegen.

## § 4 Zugangskommission

(1) Zur Vorbereitung der Zugangsentscheidung setzt die KIT-Fakultät eine Zugangskommission ein, die aus mindestens zwei Personen des hauptberuflich tätigen wissenschaftlichen Personals, davon einer/einem Professor/in, besteht. Ein/e studentische/r Vertreter/in kann mit beratender Stimme an den Zugangskommissionssitzungen teilnehmen. Eines der Mitglieder der Zugangskommission führt den Vorsitz.

(2) Für den Fall, dass aufgrund hoher Bewerberzahlen mehrere Zugangskommissionen gebildet werden, findet zu Beginn des Zugangsverfahrens in einer gemeinsamen Sitzung eine Abstimmung der Bewertungsmaßstäbe unter dem Vorsitz der/des Studiendekans/Studiendekanin statt. Am Ende des Verfahrens kann eine gemeinsame Schlussbesprechung durchgeführt werden.

(3) Die Zugangskommission berichtet dem KIT-Fakultätsrat nach Abschluss des Zugangsverfahrens über die gesammelten Erfahrungen und macht Vorschläge zur Verbesserung und Weiterentwicklung des Zugangsverfahrens.

(4) Die Amtszeit der nicht studentischen Kommissionsmitglieder beträgt zwei Jahre, die des studentischen Kommissionsmitgliedes ein Jahr. Eine Wiederbestellung ist möglich.

## § 5 Zugangsvoraussetzungen

(1) Voraussetzungen für den Zugang zum Masterstudiengang Maschinenbau sind:

1. Ein bestandener Bachelorabschluss oder mindestens gleichwertiger Abschluss in dem Studiengang Maschinenbau oder einem Studiengang mit im Wesentlichen gleichem Inhalt an einer Universität, Fachhochschule oder Berufsakademie bzw. Dualen Hochschule oder an einer ausländischen Hochschule; das Studium muss im Rahmen einer mindestens dreijährigen Regelstudienzeit und mit einer Mindestanzahl von 180 ECTS-Punkten absolviert worden sein;

2. ein mindestens 18-wöchiges Berufspraktikum, welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde (§ 6);

3. notwendige durch den Bachelorabschluss vermittelte Mindestkenntnisse und Mindestleistungen gemäß § 7;

4. dass im Masterstudiengang Maschinenbau oder einem verwandten Studiengang mit im Wesentlichen gleichem Inhalt kein endgültiges Nichtbestehen einer nach der Prüfungsordnung erforderlichen Prüfung vorliegt und der Prüfungsanspruch auch aus sonstigen Gründen noch besteht;

5. für Bewerber/innen, deren Muttersprache nicht Deutsch oder Englisch ist, der Nachweis von

   a) ausreichenden Kenntnissen der deutschen Sprache gemäß den Voraussetzungen der Zulassungs- und Immatrikulationsordnung des KIT oder

   b) ausreichenden Kenntnissen der englischen Sprache, nachgewiesen durch ein Zertifikat über das Kompetenzniveau B2 oder höher gemäß dem Gemeinsamen europäischen Referenzrahmen für Sprachen oder ein vergleichbares Zertifikat; als vergleichbar gelten ein Test of English as Foreign Language (TOEFL) mit mindestens 570 Punkten im paper-based TOEFL Test, 250 Punkten im computer-based TOEFL Test oder 88 Punkten im internet-based TOEFL Test sowie IELTS mit mindestens 6,5 Punkten. Der Nachweis englischer Sprachkenntnisse entfällt für Bewerber/innen, die ihren Bachelorabschluss in einem englischsprachigen Studiengang oder im englischsprachigen Ausland erworben haben. Die offizielle Sprache des Studienprogramms muss auf dem Abschlusszeugnis, dessen Ergänzung, im Transcript of Records oder in einer entsprechenden Bescheinigung der Hochschule vermerkt sein.

(2) Als verwandte Studiengänge gemäß Absatz 1 Nr. 4 gelten insbesondere ein Masterstudiengang Mechatronik, Mechatronik und Informationstechnik, Werkstofftechnik, Materialwissenschaft und Werkstofftechnik, Werkstoffingenieurwesen, Fahrzeugtechnik, Kraftfahrzeugtechnik, Luft- und Raumfahrttechnik, Motorentechnik, Produktionstechnik, Fertigungstechnik, Automatisierungstechnik, Entwicklung und Konstruktion, Mechanik, Mechanical Engineering, Mechatronics, Mechatronics and Information Technology, Materials Science, Automotive Engineering, Aerospace Engineering, Production Systems Engineering, Manufacturing Technology, Conception and Production in Mechanical Engineering, Computational Mechanics, Computational Mechanics of Materials and Structures, Energy Technologies, Automation. Über die Gleichwertigkeit des Bachelorabschlusses im Sinne von Absatz 1 Nr. 1 sowie die Festlegung der Studiengänge mit im Wesentlichen gleichem Inhalt im Sinne von Absatz 1 Nr. 4 über Satz 1 hinaus entscheidet die Zugangskommission des Masterstudiengangs Maschinenbau im Benehmen mit dem Prüfungsausschuss des Masterstudiengangs Maschinenbau. Bei der Anerkennung von ausländischen Abschlüssen sind die Empfehlungen der Kultusministerkonferenz sowie die Absprachen im Rahmen von Hochschulpartnerschaften zu beachten.

**§ 6 Berufspraktikum**

(1) Der Zugang zum Masterstudiengang Maschinenbau setzt ein mindestens 18-wöchiges Berufspraktikum voraus. Davon sind mindestens zwölf Wochen als Fachpraktikum abzuleisten. Maximal sechs Wochen können als Grundpraktikum abgeleistet werden.

(2) Die Tätigkeiten im **Grundpraktikum** können aus folgenden Gebieten gewählt werden:

1. spanende Fertigungsverfahren,
2. umformende Fertigungsverfahren,
3. urformende Fertigungsverfahren und
4. thermische Füge- und Trennverfahren.

Es sollen Tätigkeiten in mindestens drei der o.g. Gebiete nachgewiesen werden.

(3) Die Tätigkeiten im **Fachpraktikum** müssen inhaltlich denen eines Ingenieurs entsprechen und können beispielsweise aus folgenden Gebieten gewählt werden:

1. Wärmebehandlung,
2. Werkzeug- und Vorrichtungsbau,
3. Planung von Instandhaltung, Wartung und Reparatur,
4. Planung von Messen, Prüfen und Qualitätskontrolle,
5. Oberflächentechnik,
6. Entwicklung, Konstruktion und Arbeitsvorbereitung,
7. Montage/Demontageplanung und
8. andere fachrichtungsbezogene Tätigkeiten

Näheres regelt die Praktikumsordnung für den Bachelor- und Masterstudiengang Maschinenbau der KIT-Fakultät für Maschinenbau.

(4) Über die Anerkennung des Berufspraktikums entscheidet das Praktikantenamt der KIT-Fakultät für Maschinenbau. Zur Anerkennung ist die Vorlage eines Tätigkeitsnachweises des Unternehmens (Zeugnis) im Original, das Dauer und Art der Tätigkeit während des Praktikums beschreibt, erforderlich. Tätigkeiten, die an Universitäten, gleichgestellten Hochschulen oder in vergleichbaren Forschungseinrichtungen durchgeführt wurden, werden grundsätzlich nicht als Fachpraktikum anerkannt.

(5) Liegt das Berufspraktikum bis zum Zeitpunkt der Antragsstellung noch nicht vor, kann die/der Bewerber/in im Einzelfall trotzdem unter der Auflage zugelassen werden, dass sie/er das Berufspraktikum bis zum Ende des Prüfungszeitraums des dritten Fachsemesters, spätestens aber bei der Anmeldung der Masterarbeit, nachweist. Eine etwaige Auflage wird von der Zulassungskommission festgesetzt und der/dem Bewerber/in im Rahmen der Zulassung mitgeteilt.

### § 7 Mindestkenntnisse und Mindestleistungen

(1) Die Zulassung zum Masterstudiengang Maschinenbau setzt den Nachweis voraus, dass sich der/die Bewerber/in mindestens in folgenden Fächern Fähigkeiten erworben hat, die nach Maßgabe der Lernziele, Inhalte und Leistungspunkte entsprechend des aktuellen Modulhandbuchs des Bachelorstudiengangs Maschinenbau zu denen im Bachelorstudiengang Maschinenbau am KIT gleichwertig sind:

1. Höhere Mathematik
2. Technische Thermodynamik und Wärmeübertragung
3. Technische Mechanik
4. Maschinenkonstruktionslehre
5. Werkstoffkunde
6. Strömungslehre
7. Mess- und Regelungstechnik
8. Elektrotechnik
9. Informatik.

Über die Gleichwertigkeit nach Satz 1 entscheidet die Zugangskommission des Masterstudiengangs Maschinenbau im Benehmen mit dem Prüfungsausschuss des Masterstudiengangs Maschinenbau.

(2) Sofern Bewerber die unter Absatz 1 beschriebenen Fähigkeiten nicht nachweisen können, können sie dennoch in den Studiengang immatrikuliert werden, sofern sie die für den Studiengang erforderlichen Fähigkeiten durch Bestehen einer schriftlichen Aufnahmeprüfung gemäß Anlage 1 am KIT nachweisen. Für einen erfolgreichen Nachweis darf die erfolgreiche Teilnahme an der Aufnahmeprüfung nicht länger als vier Bewerbungsverfahren zurückliegen. Ein Bewerbungsverfahren ist die auf einen bestimmten Studienbeginn bezogene Vergabe von Studienplätzen.

### § 8 Immatrikulationsentscheidung

(1) Die Entscheidung über das Erfüllen der Zugangsvoraussetzungen und die Immatrikulation trifft die/der Präsident/in auf Vorschlag der Zugangskommission.

(2) Die Immatrikulation ist zu versagen, wenn

a) die Bewerbungsunterlagen nicht fristgemäß im Sinne des § 2 oder nicht vollständig im Sinne des § 3 vorgelegt wurden,

b) die in § 5 geregelten Voraussetzungen nicht erfüllt sind,

c) im Studiengang Maschinenbau oder in einem verwandten Studiengang mit im Wesentlichen gleichem Inhalt eine nach der Prüfungsordnung erforderliche Prüfung endgültig nicht bestanden wurde oder der Prüfungsanspruch aus sonstigen Gründen nicht mehr besteht (§ 60 Abs. 2 Nr. 2 LHG, § 9 Abs. 2 HZG).

Im Fall des § 3 Abs. 3 kann die Immatrikulation unter dem Vorbehalt zugesichert werden, dass der endgültige Nachweis über den Bachelorabschluss unverzüglich, spätestens bis zwei Monate nach Beginn des Semesters, für das die Immatrikulation beantragt wurde, nachgereicht wird. Wird der Nachweis nicht fristgerecht erbracht, erlischt die Zusicherung, und eine Immatrikulation erfolgt nicht. Hat die/der Bewerber/in die Fristüberschreitung nicht zu vertreten, hat sie/er dies gegenüber der Zugangskommission zu belegen und schriftlich nachzuweisen. Die Zugangskommission kann im begründeten Einzelfall die Frist für das Nachreichen des endgültigen Zeugnisses verlängern.

(3) Erfüllt die/der Bewerber/in die Zugangsvoraussetzungen nicht und/oder kann sie/er nicht immatrikuliert werden, wird ihr/ihm das Ergebnis des Zugangsverfahrens schriftlich mitgeteilt. Der Bescheid ist zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen.

(4) Über den Ablauf des Zugangsverfahrens ist eine Niederschrift anzufertigen.

(5) Im Übrigen bleiben die allgemein für das Zulassungs- und Immatrikulationsverfahren geltenden Bestimmungen in der Zulassungs- und Immatrikulationsordnung des KIT unberührt.

**§ 9 Inkrafttreten**

Diese Satzung tritt am Tage nach ihrer Bekanntmachung in den Amtlichen Bekanntmachungen des KIT in Kraft. Sie gilt erstmals für das Bewerbungsverfahren zum Sommersemester 2018.

Gleichzeitig tritt die Satzung für das hochschuleigene Zulassungsverfahren im Masterstudiengang Maschinenbau an der Universität Karlsruhe (TH) vom 28. Mai 2008 (Amtliche Bekanntmachungen des KIT Nr. 22 vom 28. Mai 2008), zuletzt geändert durch Satzung vom 04. August 2015 (Amtliche Bekanntmachungen des KIT Nr. 63 vom 06. August 2015) außer Kraft.

Karlsruhe, den. 22. November 2017

*Prof. Dr. Holger Hanselka*
*(Präsident)*

**Anlage 1**

**Aufnahmeprüfung**

1. **Zweck**

Die Aufnahmeprüfung soll zeigen, dass die/der Bewerber/in geeignet ist, den Masterstudiengang Maschinenbau erfolgreich zu absolvieren. Die Eignungsfeststellung erfolgt nach Maßgabe des Berufsbildes des Berufes/der Berufe, die dem Abschlussziel typischerweise folgen und anhand von Qualifikationen, die denen, welche im Bachelorstudiengang Maschinenbau am KIT erworben werden können, entsprechen.

2. **Anmeldung zur Prüfung**

2.1 Der Antrag auf Zulassung zur Aufnahmeprüfung erfolgt schriftlich bis spätestens 14 Tage vor dem Termin der Aufnahmeprüfung bei der KIT-Fakultät für Maschinenbau.

2.2 Dem Antrag ist der Nachweis über die Bewerbung für den Masterstudiengang Maschinenbau am KIT beizufügen.

2.3 Die Entscheidung über die Zulassung zur Aufnahmeprüfung gemäß Nr. 3 trifft die Zugangskommission der KIT-Fakultät für Maschinenbau (§ 4). Zur Aufnahmeprüfung zugelassene Bewerber erhalten eine Anmeldebestätigung.

**3. Zulassung zur Prüfung**

3.1 An der Aufnahmeprüfung nimmt nur teil, wer

a) sich ordnungsgemäß zur Aufnahmeprüfung angemeldet hat,

b) sich gemäß § 3 form- und fristgerecht für den Masterstudiengang Maschinenbau beworben hat und

c) erklärt, dass er nicht bereits mehr als einmal an einer Aufnahmeprüfung am KIT im Masterstudiengang Maschinenbau erfolglos teilgenommen hat.

3.2 Die Teilnahme ist zu versagen, wenn die unter 3.1 genannten Voraussetzungen nicht erfüllt sind.

**4. Durchführung**

4.1 Die genauen Termine sowie der Ort der Aufnahmeprüfung werden spätestens sechs Wochen vor dem Prüfungstermin durch das KIT auf den Internetseiten der KIT-Fakultät für Maschinenbau bekannt gegeben.

4.2 Die Aufnahmeprüfung findet in schriftlicher Form statt und dauert 90 Minuten. Sie besteht aus vier Prüfungsteilen, die Fähigkeiten aus in § 7 Abs. 1 genannten Bereichen ermitteln und zu gleichen Teilen mit 25 Punkten bewertet werden. Die mit der Aufnahmeprüfung maximal erreichbare Punktzahl beträgt 100 Punkte. Die Aufnahmeprüfung kann zu Teilen auch im Wege des Antwort-Wahl-Verfahrens durchgeführt werden. In diesem Fall findet die Satzung zur Durchführung von Antwort-Wahl-Verfahren Anwendung.

4.3 Zur Bewertung der Aufnahmeprüfung setzt die Zugangskommission (§ 4) eine Prüfungskommission ein. Sie besteht aus mindestens zwei stimmberechtigten Mitgliedern, einem/einer Hochschullehrer/in / leitenden/leitender Wissenschaftler/in gemäß § 14 Abs. 3 Ziff. 1 KITG / Privatdozentin bzw. -dozenten, und einer akademischen Mitarbeiterin/ einem akademischen Mitarbeiter nach § 52 LHG / wissenschaftlichen Mitarbeiterin/wissenschaftlichen Mitarbeiter gemäß § 14 Abs. 3 Ziff. 2 KITG sowie einer /einem Studierenden mit beratender Stimme. Die Amtszeit der nicht studentischen Kommissionsmitglieder beträgt zwei Jahre, die des studentischen Kommissionsmitgliedes ein Jahr. Eine Wiederbestellung ist möglich.

4.4 Die Aufnahmeprüfung wird mit 0 Punkten bewertet, wenn die/der Bewerber/in zum Prüfungstermin ohne wichtigen Grund nicht erscheint. Tritt die/der Bewerber/in nach Ausgabe der Prüfungsaufgaben von der Aufnahmeprüfung zurück, wird sie/er nach dem bis zu diesem Zeitpunkt erzielten Ergebnis bewertet. Die/der Bewerber/in ist berechtigt, erneut an einer Aufnahmeprüfung teilzunehmen, wenn unverzüglich nach dem Termin der Aufnahmeprüfung dem KIT angezeigt und glaubhaft gemacht wird, dass für das Fehlen am Termin oder den Rücktritt von der Prüfung ein wichtiger Grund vorgelegen hat; bei Krankheit ist ein ärztliches Attest vorzulegen.

4.5 Versucht die/der Bewerber/in das Ergebnis der Aufnahmeprüfung durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, wird die Prüfung mit 0 Punkten bewertet. Ein/e Bewerber/in, die/der den ordnungsgemäßen Ablauf der Prüfung stört, kann von dem jeweiligen Aufsichtsführenden von der Fortsetzung der Prüfung ausgeschlossen werden; in diesem Fall wird die Prüfung mit 0 Punkten bewertet.

4.6 Das KIT übernimmt keine Kosten, die durch die Aufnahmeprüfung für die Bewerber/innen entstehen.

**5. Ermittlung der Eignung und Mitteilung des Ergebnisses**

5.1 Die Aufnahmeprüfung ist bestanden, wenn die/der Bewerber/in mindestens 75 Punkte, dabei mindestens 15 Punkte in jedem der vier Teilbereiche erreicht.

5.2 Die Zugangskommission (§ 4) stellt die Eignung der Bewerberin/ des Bewerbers auf Vorschlag der Prüfungskommission fest. Das Ergebnis der Aufnahmeprüfung wird den Bewerberinnen/Bewerbern schriftlich durch die KIT-Fakultät für Maschinenbau mitgeteilt. Der Bescheid ist zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen.

**6. Wiederholung**

Bewerber/innen, die einmal erfolglos an einer Aufnahmeprüfung für den Masterstudiengang Maschinenbau am KIT teilgenommen haben, können sich frühestens im nächsten Bewerbungszeitraum einmalig erneut zur Aufnahmeprüfung für diesen Studiengang anmelden. Eine weitere Wiederholung ist nicht möglich.

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Karlsruher Institut für Technologie

# Amtliche Bekanntmachung

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**Satzung zur Änderung der Satzung für den Zugang zu dem Masterstudiengang Maschinenbau am Karlsruher Institut für Technologie (KIT)**

vom 28. November 2018

Aufgrund von § 10 Abs. 2 Ziff. 6 und § 20 des KIT-Gesetzes (KITG) in der Fassung vom 14. Juli 2009 (GBl. S. 317 ff), zuletzt geändert durch Artikel 2 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85, 94), §§ 59 Abs. 1, 63 Abs. 2 des Landeshochschulgesetzes (LHG) in der Fassung vom 1. Januar 2005 (GBl. S. 1 ff), zuletzt geändert durch Artikel 1 des Gesetzes zur Weiterentwicklung des Hochschulrechts (HRWeitEG) vom 13. März 2018 (GBl S. 85 ff.), hat der KIT-Senat in seiner Sitzung am 19. November 2018 die nachstehende Satzung beschlossen.

**Artikel 1**

1. **§ 3 Abs. 2 Ziff. 3 wird wie folgt geändert:**

   Nach dem Wort „Berufspraktikum“ werden die Worte „welches durch das Praktikantenamt der KIT-Fakultät für Maschinenbau anerkannt wurde“ gestrichen.

2. **§ 5 Abs. 1 Ziff. 3 wird wie folgt geändert:**

   Nach dem Wort „notwendige“ werden die Worte „durch den Bachelorabschluss vermittelte“ gestrichen.

3. **§ 5 Abs. 1 Ziff. 5 Buchst. b) erhält folgende Fassung:**

   „b) ausreichenden englischen Sprachkenntnisse, die mindestens dem Niveau B2 des Gemeinsamen Europäischen Referenzrahmens für Sprachen (GER) oder gleichwertig entsprechen, nachgewiesen beispielsweise durch einen der folgenden international anerkannten Tests:

   aa) Test of English as Foreign Language (TOEFL) mit mindestens 550 Punkten im paper-based Test, oder 88 Punkten im internet-based Test oder

   bb) IELTS mit einem Gesamtergebnis von mindestens 6.5 und keiner Section unter 5.5.

   Der Nachweis englischer Sprachkenntnisse entfällt für Bewerber/innen, die ihren Bachelorabschluss in einem englischsprachigen Studiengang oder im englischsprachigen Ausland erworben haben. Die offizielle Sprache des Studienprogramms muss auf dem Abschlusszeugnis, dessen Ergänzung, im Transcript of Records oder in einer entsprechenden Bescheinigung der Hochschule vermerkt sein.“

4. **§ 6 Abs. 5 erhält folgende Fassung:**

   „**(5)** Liegt das Berufspraktikum oder die Anerkennung des Praktikums bis zum Zeitpunkt der Antragsstellung noch nicht vor, kann die/der Bewerber/in im Einzelfall trotzdem unter der Auflage zugelassen werden, dass sie/er das Berufspraktikum bis zum Ende des Prüfungszeitraums des dritten Fachsemesters, spätestens aber bei der Anmeldung der Masterarbeit, nachweist. Eine etwaige Auflage wird von der Zulassungskommission festgesetzt und der/dem Bewerber/in im Rahmen der Zulassung mitgeteilt.“

5. **Anlage 1 Ziff. 5.1 erhält folgende Fassung:**
„5.1 Die Aufnahmeprüfung ist bestanden, wenn die/der Bewerber/in mindestens 50 Punkte, dabei mindestens 12 Punkte in jedem der vier Teilbereiche erreicht.“

**Artikel 2**

Diese Satzung tritt am Tage nach ihrer Bekanntmachung in den Amtlichen Bekanntmachungen des KIT in Kraft. Sie gilt erstmals für das Bewerbungsverfahren zum Sommersemester 2019.

Karlsruhe, 28. November 2018

*gez. Prof. Dr. Holger Hanselka*
*(Präsident)*