Module Handbook
Mechanical Engineering Bachelor (2016)
SPO 2016, for study beginners from winter term 2018/2019
Summer Term 2019
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## 1.1 Orientation Exam

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## 1.2 Bachelor Thesis

### Credits 15

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## 1.3 Fundamentals of Engineering

### Credits 143

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<td>M-MACH-102638 Major Field: Rail System Technology</td>
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<td>M-MACH-102815 Major Field: Engineering Design</td>
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### 1.5 Interdisciplinary Qualifications

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**Mandatory**

| M-MACH-102576 Key Competences | 6 CR |
2 Modules

2.1 Module: Advanced Mathematics [M-MATH-102859]

**Responsible:** Prof. Dr. Roland Griesmaier

**Organisation:** KIT Department of Mathematics

**Part of:** Fundamentals of Engineering

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<td>T-MATH-100275</td>
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<td>T-MATH-100277</td>
<td>Advanced Mathematics III</td>
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**Competence Certificate**

Learning assessment is carried by three written examinations of length 120 minutes each and by three sets of homework assignments (pre-requisites). A “pass” result on a pre-requisites in Advanced Mathematics I, II and III, respectively, is a requirement for registration for the corresponding written examination.

**Competence Goal**

The students know the fundamentals of one-dimensional calculus. They can reliably use limits, functions, power series and integrals. They understand central concepts such as continuity, differentiability or integrability and they know important statements about these concepts. The students can follow the arguments leading to these statements as presented in the lectures and are able to independently prove simple assertions based on these statements.

The students know the fundamentals of linear algebra. They are able to use vectors, linear maps and matrices without problems. They have basic knowledge about Fourier series. The students also can theoretically and practically deal with initial value problems of ordinary differential equations. They can make use of classical solution techniques for linear differential equations.

The students know about differential calculus for vector-valued functions of several variables and about techniques of vector calculus such as the definition and application of differential operators, the computation of domain, line and surface integrals and important integral theorems. They have basic knowledge about partial differential equations and know basic facts from stochastics.

**Prerequisites**

None.

**Content**

Fundamentals, sequences and convergence, functions and continuity, series, differential calculus of one real variable, integral calculus, vector spaces, linear maps, eigenvalues, Fourier series, differential equations, Laplace transform, multidimensional calculus, domain integrals, vector calculus, partial differential equations, stochastics
Workload

In class: 270 hours

- lectures, tutorials and examinations

Independent study: 360 hours

- independent review of course material
- work on homework assignments
- preparation for written exams

Learning type

Lecture, problem classes, tutorials
2.2 Module: Bachelor Thesis [M-MACH-104494]

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

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**Mandatory**

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<th>Bachelor Thesis</th>
<th>12 CR Heilmaier</th>
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<tbody>
<tr>
<td>T-MACH-109189</td>
<td>Presentation</td>
<td>3 CR Heilmaier</td>
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</table>

**Competence Certificate**  
The module Bachelor Thesis consists of a written bachelor thesis and an oral presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The bachelor 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 work load of the bachelor thesis corresponds to 12 ECTS. The maximal processing time of the bachelor thesis takes three months.

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 bachelor 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 bachelor thesis is not completed in time, this examination is "failed" (5.0), unless the student is not responsible.

The bachelor 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 bachelor thesis is graded by the examination board within this assessment; another expert can be appointed too. The bachelor 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 bachelor thesis. The presentation should last around 20 minutes, corresponds to 3 ECTS, 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, 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 a question, is able to choose scientific methods and techniques, and use them to solve the question or to identify other potentials. In general, 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. He/she is able to clearly structure a scientific work and (a) to communicate it in written form using technical terminology as well as (b) to present it in oral form and discuss it with experts.

**Prerequisites**  
The requirement for admission to the bachelor thesis module are 120 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 120 credits in the following fields:
   - Fundamentals of Engineering
   - Interdisciplinary Qualifications
   - Specialization in Mechanical Engineering

**Content**  
The student shall be allowed to make suggestions for the topic of his/her bachelor 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 bachelor thesis is about 450 hours.
Module: Compulsory Elective Module (BSc-Modul WPF) [M-MACH-102746]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (mandatory)

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<tr>
<td>T-MACH-105381 Virtual Engineering (Specific Topics)</td>
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<td>T-MACH-105212 CAE-Workshop</td>
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<td>T-MACH-100535 Introduction into Mechatronics</td>
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<tr>
<td>T-MACH-105209 Introduction into the Multi-Body Dynamics</td>
</tr>
<tr>
<td>T-MACH-102093 Fluid Power Systems</td>
</tr>
<tr>
<td>T-MACH-102163 Basics of Technical Logistics</td>
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<tr>
<td>T-MACH-105213 Fundamentals of Combustion I</td>
</tr>
<tr>
<td>T-MACH-105210 Machine Dynamics</td>
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<tr>
<td>T-MACH-105452 Mathématiques appliquées aux sciences de l’ingénieur</td>
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<td>T-MACH-105293 Mathematical Methods in Dynamics</td>
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<tr>
<td>T-MACH-100297 Mathematical Methods in Strength of Materials</td>
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<td>T-MACH-105294 Mathematical Methods of Vibration Theory</td>
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<td>T-MACH-105295 Mathematical Methods in Fluid Mechanics</td>
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<td>T-MACH-105303 Modelling of Microstructures</td>
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<td>T-MACH-100530 Physics for Engineers</td>
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<td>T-MACH-105652 Fundamentals of Combustion Engine Technology</td>
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<td>T-MACH-102083 Integrated Information Systems for Engineers</td>
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<td>T-MACH-105290 Vibration Theory</td>
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<td>T-MACH-106830 Tutorial Mathematical Methods in Strength of Materials</td>
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</table>

**Competence Certificate**  
oral/written exam

**Competence Goal**  
The elective course serves as a comprehensive, in-depth analysis of fundamentals in selected areas of mechanical engineering. The specific learning outcomes are defined by the respective coordinator of the course.

**Prerequisites**  
None

**Annotation**  
Compulsory elective subjects have to be chosen from the corresponding catalogues as displayed in the bachelor’s program with an amount of 4 credit points (see Studienplan or Module Handbook)
Workload
The work load is about 120 hours, corresponding to 4 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
Lectures, Tutorials
2.4 Module: Computer Science (BSc-Modul 09, Inf) [M-MACH-102563]

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

Part of: Fundamentals of Engineering

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<tr>
<td>T-MACH-105206</td>
<td>Computer Science for Engineers</td>
<td>0 CR</td>
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Competence Certificate
Written examination "Computer Science for Engineers", 100%, 180 minutes; Examination prerequisite: passed lap course.

Competence Goal
Students can identify and explain fundamental terms, problems and concepts of computer science. They can apply the basic methods of the OO modeling with UML and implement the object-oriented programming (OOP) with the programming language JAVA.

Module grade calculation
Examination result "Computer Science for Engineers" 100%

Prerequisites
None

Content
Basics: Information representation- and processing, terms and definitions: alphabet, data, signals, information, numeral systems, propositional logic and Boolean algebra, computer architectures, programming paradigms.
Object Orientation: Definition and important characteristics of object orientation. Object-oriented modeling with UML.
Data Structures: Definition, properties and application of graphs, trees, linked lists, queues and stacks.
Algorithms: Characteristics of algorithms, complexity analysis, design methods, important examples.
Database management systems: Relational data model, relational algebra, declarative language SQL. Basics and concepts of JAVA. Introduction to programming using JAVA.

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.
For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
Attendance time: 63 hours
Self-study: 117 hours

Learning type
Lecture and Lab Course
Module: Electrical Engineering [M-ETIT-104049]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Fundamentals of Engineering (Usage until 3/7/2019)

<table>
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Mandatory

| T-ETIT-108386 | Electrical Engineering and Electronics | 8 CR | Becker |

Competence Certificate
Written exam, duration 3 hours.

Prerequisites
none

Annotation
Exam and Lecture will be held in English.
# 2.6 Module: Electrical Engineering [M-ETIT-104801]

** Responsible:** Dr.-Ing. Klaus-Peter Becker  
** Organisation:** KIT Department of Electrical Engineering and Information Technology  
** Part of:** Fundamentals of Engineering (Usage from 3/8/2019)

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**Mandatory**

| T-ETIT-109820 | Electrical Engineering and Electronics | 8 CR | Becker |
Module: Engineering Mechanics (BSc-Modul 03, TM) [M-MACH-102572]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Wolfgang Seemann

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

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<td>4 term</td>
<td>Deutsch/Englisch</td>
<td>Seemann</td>
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</tbody>
</table>

Competence Certificate

prerequisites EM I, II (see T-MACH-100528 "Engineering Mechanics I (Tutorial)" as well as T-MACH-100284 "Engineering Mechanics II (Tutorial)"); they consist of solving problems of the work sheets in four categories: written mandatory homework, written homework, computational homework, colloquia.

prerequisites EM III, IV

"Engineering Mechanics I", written exam, 90 minutes; graded;
"Engineering Mechanics II", written exam, 90 minutes; graded;
"Engineering Mechanics III/IV", written exam, 180 Minutes; graded;

The final grade of this module is computed as ECTS-based weighted sum of the included exams.

Competence Goal

After having finished the lectures EM I and EM II the students can

- assess stress and strain distributions for the basic load cases within the framework of elasticity and thermoelectricity
- compute and evaluate 3D stress and strain states
- apply the principle of virtual displacements
- apply energy methods and evaluate approximate solutions
- evaluate the stability of equilibrium positions
- solve worksheet problems to topics of the lecture using the computer algebra system MAPLE

In EM III and EM IV the students learn to analyse the motion of points and systems. Based on the axioms of Newton and Euler they know how to derive equations of motion. Besides the synthetic methods they get familiar with analytical methods which are based on energy expressions and can be applied efficiently and formalised. These methods are introduced in the scope of systems of mechanical engineering so that students can determine and analyse motions and the forces which are generated by these motions.

Prerequisites

None
Content
This Module consists of the courses "Engineering Mechanics I (lecture)" up to "Engineering Mechanics IV (lecture)" as well as "Engineering Mechanics I (Tutorial)" up to "Engineering Mechanics IV (Tutorial)"

Contents of "Engineering Mechanics I": basics of vector calculus; force systems; statics of rigid bodies; internal forces and moments in bars and beams; friction; centre of gravity, centre of mass; work, energy, principle of virtual work; statics of inextensible ropes; elastostatics of tension-compression-bars

Contents of "Engineering Mechanics II": bending; shear; torsion; stress and strain state in 3D; Hooke's law in 3D; elasticity theorems in 3D; energy methods in elastostatics; approximation methods; stability

Contents of "Engineering Mechanics III":

Kinetics of a particle:
Newton's axiom, Principle of d'Alembert, work of a force, kinetic and potential energies, principle of linear momentum, principle of moment of momentum, kinetics in moving reference systems

Systems of particles:
Principle of center of mass, Principle of moment of momentum, impacts between particles, systems with variable mass, applications.

Plain motion of rigid bodies:

Contents of "Engineering Mechanics IV":
Spatial kinematics of a rigid body, Euler angles, angular velocity using Euler angles, Euler's equations, inertia tensor, kinetic energy of a rigid body, free gyroscopes, forced gyroscopes, systems of rigid bodies, principle of d'Alembert, Lagrange's equations of the first and second kind, generalized coordinates, free and forced vibration of one degree of freedom systems, frequency response, vibration of multi degree of freedom systems, vibration absorption

Annotation
For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
lectures and exercises: 204h
homework and preparation of examination: 486h

Learning type
Lectures, Tutorials, Lab course groups, attestation of solved work sheets, colloquium, consultation hours (optional)
2.8 Module: Fluid Mechanics (BSc-Modul 12, SL) [M-MACH-102565]

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

Part of: Fundamentals of Engineering

<table>
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Mandatory

| T-MACH-105207 | Fluid Mechanics 1&2 | 8 CR | Frohnapfel |

Competence Certificate
Common examination of "Fluid Mechanics I" and "Fluid Mechanics II"; written exam, 3 hours (graded)

Competence Goal
After having completed this module the student is capable of deriving the mathematical equations that describe the motion of fluids and can determine flow quantities for generic problems. He/she can name characteristic properties of fluids and distinguish different flow states. The student is capable of determining fluid quantities in fundamental applications. This includes the calculation of:

- static and dynamic forces acting from the fluid onto the solid
- two-dimensional viscous flows
- one-dimensional incompressible and compressible flows without losses
- lossy flows through pipes

Module grade calculation
result of exam

Prerequisites
none

Content
properties of fluids, surface tension, hydro- and aerostatics, kinematics, stream tube theory (compressible and incompressible), losses in pipeline systems, dimensional analysis, dimensionless numbers
tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.
For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
regular attendance: 64 hourself-study: 176 hours

Learning type
Lectures + tutorials

Literature
Zierep J., Bühler, K.: Grundzüge der Strömungslehre, Grundlagen, Statik und Dynamik der Fluide, Springer Vieweg
Kuhlmann, H.: Strömungsmechanik, Pearson Studium
Spurk, J.H.: Strömungslehre, Einführung in die Theorieder Strömungen, Springer-Verlag
2.9 Module: Key Competences (BSc-Modul 07, SQL) [M-MACH-102576]

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

Part of: Interdisciplinary Qualifications

<table>
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<td>T-MACH-105296</td>
<td>Working Methods in Mechanical Engineering</td>
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<td>Deml</td>
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<tr>
<td>T-MACH-106375</td>
<td>Value stream within enterprises – The value chain at Bosch</td>
<td>2</td>
<td>Maier</td>
</tr>
</tbody>
</table>

Election block: Schlüsselqualifikationen wählbare LV von HoC, ZAK (at least 2 credits)

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
non graded

Prerequisites
none

Content
The module Key Competences consists "Working Methods in Mechanical Engineering" and a 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 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 180 hours, corresponding to 6 credit points in the Bachelor 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.
Module: Machines and Processes (mach13BSc-Modul 13, MuP) [M-MACH-102566]

Responsible: Dr.-Ing. Heiko Kubach
Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

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<tr>
<td>T-MACH-105208</td>
<td>Machines and Processes</td>
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<td>T-MACH-105232</td>
<td>Machines and Processes, Prerequisite</td>
<td>0 CR</td>
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</table>

Bauer, Kubach, Maas, Pritz

Competence Certificate
written exam (2 h)

Competence Goal
The students can name and describe basic energy conversion processes and energy converting machines. They can explain the application of these energy conversion processes in various machines. They can analyze and evaluate the processes and machines in terms of functionality and efficiency and they are able to solve basic technical problems in terms of operating the machines.

Module grade calculation
Grade out of written exam (100%)

Prerequisites
None.

Content

- Internal combustion engines
- Hydraulic fluid machinery
- Thermal turbo machines
- Thermodynamics

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
regular attendance: 48 h
self-study: 162 h

Learning type
Lecture+Tutorial
Lab Course
2.11 Module: Major Field: Combustion Engine Techniques (SP 57) [M-MACH-102645]

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

Part of: Specialization in Mechanical Engineering (Schwerpunkt)

<table>
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### Mandatory

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<tr>
<td>T-MACH-105652</td>
<td>Fundamentals of Combustion Engine Technology</td>
<td>5</td>
<td>Bernhardt, Kubach, Pfeil, Toedter, Wagner</td>
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#### Election block: Technik des Verbrennungsmotors (K) (at least 3 credits)

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>T-MACH-105173</td>
<td>Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines</td>
<td>4</td>
<td>Gohl</td>
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<tr>
<td>T-MACH-105184</td>
<td>Fuels and Lubricants for Combustion Engines</td>
<td>4</td>
<td>Kehrwald, Kubach</td>
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<tr>
<td>T-MACH-105169</td>
<td>Engine Measurement Techniques</td>
<td>4</td>
<td>Bernhardt</td>
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#### Election block: Technik des Verbrennungsmotors (E) ()

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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>T-MACH-105655</td>
<td>Alternative Powertrain for Automobiles</td>
<td>4</td>
<td>Noreikat</td>
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<tr>
<td>T-MACH-105451</td>
<td>Drive Systems and Possibilities to Increase Efficiency</td>
<td>2</td>
<td>Kollmeier</td>
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<tr>
<td>T-MACH-105716</td>
<td>Numerical Methods for combustion process development</td>
<td>2</td>
<td>Kubach, Waldenmaier</td>
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<tr>
<td>T-MACH-105044</td>
<td>Fundamentals of Catalytic Exhaust Gas Aftertreatment</td>
<td>4</td>
<td>Deutschmann, Grunwaldt, Kubach, Lox</td>
</tr>
<tr>
<td>T-MACH-105985</td>
<td>Ignition systems</td>
<td>4</td>
<td>Toedter</td>
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#### Election block: Technik des Verbrennungsmotors (P) (at most 4 credits)

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Lecturer(s)</th>
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<tbody>
<tr>
<td>T-MACH-105337</td>
<td>Engine Laboratory</td>
<td>4</td>
<td>Wagner</td>
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</tbody>
</table>

### Competence Certificate

Oral exam, written exam, lab course reports (see description of bricks)

### Competence Goal

After completion of this „Schwerpunkt“ students are able to

- Describe and explain the working principle of different engine types
- Name the challenges in engine development
- Describe the correlations between engine operation, application parameters and emissions

### Prerequisites

None

### Content

The focus of this "Schwerpunkt" are the basic design and the working principle of internal combustion engines. Different types of engines such as gasoline engine, diesel engine and gas engine are subject. The fundamental thermodynamic aspects as well as the mechanical aspects are discussed. The influence of application parameters and the correlation of engine concepts, fuels and emissions are addressed.

### Workload

The work load is 360 hours, corresponding to 12 credit points.

### Learning type

Lectures, Exercises, Lab Courses
2.12 Module: Major Field: Continuum Mechanics (SP 13) [M-MACH-102582]

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

Part of: Specialization in Mechanical Engineering (Schwerpunkt)

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

<table>
<thead>
<tr>
<th>Election block: Festigkeitslehre / Kontinuumsmechanik (K) (at least 8 credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-MACH-100296       Advanced Methods in Strength of Materials</td>
</tr>
<tr>
<td>T-MACH-100297       Mathematical Methods in Strength of Materials</td>
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<tr>
<th>Election block: Festigkeitslehre / Kontinuumsmechanik (E) (at most 6 credits)</th>
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<tbody>
<tr>
<td>T-MACH-105212       CAE-Workshop</td>
</tr>
<tr>
<td>T-MACH-105320       Introduction to the Finite Element Method</td>
</tr>
<tr>
<td>T-MACH-105293       Mathematical Methods in Dynamics</td>
</tr>
<tr>
<td>T-MACH-105384       Computerized Multibody Dynamics</td>
</tr>
<tr>
<td>T-MACH-102140       Failure of Structural Materials: Deformation and Fracture</td>
</tr>
<tr>
<td>T-MACH-109302       Computational Homogenization on Digital Image Data</td>
</tr>
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<table>
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<tr>
<th>Election block: Festigkeitslehre / Kontinuumsmechanik (Ü) ()</th>
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<tbody>
<tr>
<td>T-MACH-106830       Tutorial Mathematical Methods in Strength of Materials</td>
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</table>

Competence Goal
After having finished this major field the students can

- list important concepts and models of continuum mechanics
- analyse and evaluate models for describing the material behaviour
- apply these models in given problems

Prerequisites
None

Learning type
lectures, tutorials, computer tutorial, consultation hours
### 2.13 Module: Major Field: Energy Converting Engines [M-MACH-102838]

**Responsible:** Prof. Dr. Thomas Koch  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

<table>
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**Election block: Kraft- und Arbeitsmaschinen (K) (at least 8 credits)**

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>T-MACH-105326</td>
<td>Hydraulic Fluid Machinery</td>
<td>8</td>
<td>CR</td>
<td>Pritz</td>
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<tr>
<td>T-MACH-105363</td>
<td>Thermal Turbomachines I</td>
<td>6</td>
<td>CR</td>
<td>Bauer</td>
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<tr>
<td>T-MACH-102194</td>
<td>Combustion Engines I</td>
<td>4</td>
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<td>Koch, Kubach</td>
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**Election block: Kraft- und Arbeitsmaschinen (E) ()**

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<td>T-CIWVT-105780</td>
<td>Design of a jet engine combustion chamber</td>
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<td>T-MACH-105184</td>
<td>Fuels and Lubricants for Combustion Engines</td>
<td>4</td>
<td>CR</td>
<td>Kehrwald, Kubach</td>
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<tr>
<td>T-MACH-105512</td>
<td>Experimental Fluid Mechanics</td>
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<td>T-MACH-102093</td>
<td>Fluid Power Systems</td>
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<td>T-MACH-105533</td>
<td>Gasdynamics</td>
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<tr>
<td>T-MACH-105044</td>
<td>Fundamentals of Catalytic Exhaust Gas Aftertreatment</td>
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<td>Deutschmann, Grunwaldt, Kubach, Lox</td>
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**Election block: Kraft- und Arbeitsmaschinen (P) (at most 4 credits)**

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<tr>
<td>T-MACH-105213</td>
<td>Fundamentals of Combustion I</td>
<td>4</td>
<td>CR</td>
<td>Maas, Sommerer</td>
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<tr>
<td>T-MACH-105325</td>
<td>Fundamentals of Combustion II</td>
<td>4</td>
<td>CR</td>
<td>Maas</td>
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<td>T-MACH-105338</td>
<td>Numerical Fluid Mechanics</td>
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<td>T-MACH-105441</td>
<td>Development of Oil-Hydraulic Powertrain Systems</td>
<td>4</td>
<td>CR</td>
<td>Ays, Geerling</td>
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<td>T-MACH-107447</td>
<td>Reliability Engineering 1</td>
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<td>T-MACH-105364</td>
<td>Thermal Turbomachines II</td>
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<td>Turbo Jet Engines</td>
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<td>T-MACH-105234</td>
<td>Windpower</td>
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**Competition Certificate**  
refer to different brick descriptions of SP24

**Competition Goal**  
Die Studierenden erwerben in den grundlagenorientierten Kernfächen 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 Lösungansätze 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 anwenden,
- grundlegende Theorien, Methoden und Eigenschaften für die verschiedenen Anwendungsfelder der Kraft- und Arbeitsmaschinen benennen und diese einsetzen und bewerten.

**Prerequisites**  
None

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Mechanical Engineering Bachelor (2016)  
Module Handbook as of 01.04.2019
Content
refer to different brick descriptions of SP24

Recommendation
Recommended compulsory optional subject: Heat and mass transfer

Workload
The work load is 360 hours, corresponding to 12 credit points.

Learning type
Lectures and Exercises
2.14 Module: Major Field: Engineering Design (SP 10) [M-MACH-102815]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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**Election block: Entwicklung und Konstruktion (K) (at least 8 credits)**

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<td>Powertrain Systems Technology A: Automotive Systems</td>
<td>4 CR</td>
<td>Albers, Ott</td>
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<tr>
<td>T-MACH-105216</td>
<td>Powertrain Systems Technology B: Stationary Machinery</td>
<td>4 CR</td>
<td>Albers, Ott</td>
</tr>
<tr>
<td>T-MACH-105221</td>
<td>Lightweight Engineering Design</td>
<td>4 CR</td>
<td>Albers, Burkardt, Revfi</td>
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**Election block: Entwicklung und Konstruktion (E) ()**

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<th>Course Code</th>
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<tr>
<td>T-MACH-105215</td>
<td>Applied Tribology in Industrial Product Development</td>
<td>4 CR</td>
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<td>T-MACH-105311</td>
<td>Design and Development of Mobile Machines</td>
<td>4 CR</td>
<td>Geimer, Siebert</td>
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<td>T-MACH-105212</td>
<td>CAE-Workshop</td>
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<td>Vehicle Ergonomics</td>
<td>4 CR</td>
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<td>T-MACH-102105</td>
<td>Manufacturing Technology</td>
<td>8 CR</td>
<td>Schulze, Zanger</td>
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<td>Fundamentals for Design of Motor-Vehicle Bodies II</td>
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<td>T-MACH-105163</td>
<td>Fundamentals of Automobile Development II</td>
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<td>T-MACH-105188</td>
<td>Integrative Strategies in Production and Development of High Performance Cars</td>
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<td>Leadership and Management Development</td>
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<td>Leadership and Conflict Management</td>
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<td>Strategic product development - identification of potentials of innovative products</td>
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<td>Technical Design in Product Development</td>
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<td>Machine Tools and Industrial Handling</td>
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**Election block: Entwicklung und Konstruktion (P) (at most 4 credits)**

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<td>T-MACH-105370</td>
<td>Laboratory Mechatronics</td>
<td>4 CR</td>
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**Election block: Entwicklung und Konstruktion (Ü) ()**

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<td>Design and Development of Mobile Machines - Advance</td>
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**Competition Goal**
The students are able to transfer their knowledge and abilities in product engineering to mechanical systems in research and industrial practice.

**Prerequisites**
None
Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
lectures
auditorium exercises
workshops
2.15 Module: Major Field: Fundamentals of Energy Technology [M-MACH-102816]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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**Mandatory**

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**Election block: Grundlagen der Energietechnik (K) ()**

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<td>Introduction to Nuclear Energy</td>
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<td>T-MACH-105325</td>
<td>Fundamentals of Combustion II</td>
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<td>T-MACH-105326</td>
<td>Hydraulic Fluid Machinery</td>
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**Election block: Grundlagen der Energietechnik (E) ()**

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<td>Selected Problems of Applied Reactor Physics and Exercises</td>
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<td>Energy Efficient Intralogistic Systems</td>
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<td>T-MACH-105952</td>
<td>Energy Storage and Network Integration</td>
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<td>Jäger, Stieglitz</td>
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<td>T-MACH-105533</td>
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<td>4 CR</td>
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<td>Solar Thermal Energy Systems</td>
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<td>T-MACH-105403</td>
<td>Flows and Heat Transfer in Energy Technology</td>
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<td>T-MACH-105225</td>
<td>Thermal Solar Energy</td>
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<td>Stieglitz</td>
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<td>T-MACH-105234</td>
<td>Windpower</td>
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<td>Lewald</td>
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<td>T-MACH-105338</td>
<td>Numerical Fluid Mechanics</td>
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**Election block: Grundlagen der Energietechnik (P) (at most 4 credits)**

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<tbody>
<tr>
<td>T-MACH-105331</td>
<td>Laboratory Exercise in Energy Technology</td>
<td>4 CR</td>
<td>Bauer, Maas, Wirbser</td>
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<tr>
<td>T-MACH-106707</td>
<td>Workshop on computer-based flow measurement techniques</td>
<td>4 CR</td>
<td>Bauer</td>
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**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
2.16 Module: Major Field: Information Management (SP 17) [M-MACH-102583]

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

Part of: Specialization in Mechanical Engineering (Schwerpunkt)

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Elective block: Informationsmanagement (K) (at least 8 credits)

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<td>T-MACH-106457</td>
<td>I4.0 Systems platform</td>
<td>4 CR</td>
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<td>T-MACH-105147</td>
<td>Product Lifecycle Management</td>
<td>4 CR</td>
<td>Ovtcharova</td>
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<tr>
<td>T-MACH-102083</td>
<td>Integrated Information Systems for Engineers</td>
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Elective block: Informationsmanagement (E) ()

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<td>Agile product innovation management - value-driven planning of new products</td>
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<td>T-MACH-105212</td>
<td>CAE-Workshop</td>
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<td>Albers</td>
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<tr>
<td>T-MACH-102209</td>
<td>Information Engineering</td>
<td>3 CR</td>
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<tr>
<td>T-MACH-102128</td>
<td>Information Systems and Supply Chain Management</td>
<td>3 CR</td>
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<td>T-MACH-105187</td>
<td>IT-Fundamentals of Logistics</td>
<td>4 CR</td>
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<td>PLM for Product Development in Mechatronics</td>
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<td>Product, Process and Resource Integration in the Automotive Industry</td>
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<td>Project Management in Global Product Engineering Structures</td>
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<td>Gutzmer</td>
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<td>T-MACH-105181</td>
<td>Supply Chain Management</td>
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<td>T-MACH-105358</td>
<td>Sustainable Product Engineering</td>
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Elective block: Informationsmanagement (P) (at most 4 credits)

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<td>T-MACH-102187</td>
<td>CAD-NX Training Course</td>
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<td>PLM-CAD Workshop</td>
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<td>T-MACH-102149</td>
<td>Virtual Reality Practical Course</td>
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Competence Certificate
Examination of other kind and oral and/or written examination: duration 2 hours.

Competence Goal
The students should:
Understand the relevance of information management in product development in consideration of increasing product and process complexity.
Gain basic knowledge in handling information, which is generated by product development activities along the lifecycle.

Prerequisites
None

Content
Generation and management of information
Architecture and functionality of information systems
CAX-systems

Workload
360 hours
### 2.17 Module: Major Field: Information Technology [M-MACH-102817]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

#### Credits 12  
**Recurrence** Once  
**Language** Deutsch/Englisch  
**Level** 3  
**Version** 1

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<tr>
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<td>4 CR</td>
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<td>T-MACH-105223 Machine Vision</td>
<td>8 CR</td>
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<td>T-MACH-102128 Information Systems and Supply Chain Management</td>
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**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 and 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 engineering
- Techniques of sensor data processing
- Concepts of control theory
- Electronic devices for data processing
Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
lecture, practical training, exercise, prakticat training in laboratory
### Module: Major Field: Materials Science and Engineering (SP 26) [M-MACH-102819]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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<td>4 CR</td>
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<td>Failure Analysis</td>
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<td>Welding Technology</td>
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<td>Fatigue of Metallic Materials</td>
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<td>Failure of Structural Materials: Fatigue and Creep</td>
<td>4 CR</td>
<td>Gruber, Gumbsch</td>
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<tr>
<td>T-MACH-102140</td>
<td>Failure of Structural Materials: Deformation and Fracture</td>
<td>4 CR</td>
<td>Gumbsch, Weygand</td>
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<tr>
<td>T-MACH-107684</td>
<td>Materials Characterization</td>
<td>6 CR</td>
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<td>T-MACH-105211</td>
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<td>4 CR</td>
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<td>Exercises for Materials Characterization</td>
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<td>Biomechanics: design in nature and inspired by nature</td>
<td>4 CR</td>
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</table>

**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 12 credit points in the bachelor’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 180 hours in the Bachelor of Science program, whereof the presence time is 66 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.
# 2.19 Module: Major Field: Mechatronics (SP 31) [M-MACH-102820]

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

**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

<table>
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<th>Credits</th>
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### Election block: Mechatronik (K) (at least 8 credits)

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<td>Jakob, Mikut, Reischl</td>
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<td>T-MACH-105694</td>
<td>Data Analytics for Engineers</td>
<td>5 CR</td>
<td>Ludwig, Mikut, Reischl</td>
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<td>T-MACH-100535</td>
<td>Introduction into Mechatronics</td>
<td>6 CR</td>
<td>Böhland, Lorch, Reischl</td>
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<td>Introduction into the Multi-Body Dynamics</td>
<td>5 CR</td>
<td>Seemann</td>
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<td>T-MACH-105218</td>
<td>Automotive Vision</td>
<td>6 CR</td>
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<td>T-MACH-105539</td>
<td>Modern Control Concepts I</td>
<td>4 CR</td>
<td>Groell, Matthes</td>
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<td>T-MACH-105367</td>
<td>Behaviour Generation for Vehicles</td>
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### Election block: Mechatronik (E) ()

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<td>T-MACH-102150</td>
<td>BUS-Controls</td>
<td>4 CR</td>
<td>Becker, Geimer</td>
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<td>T-MACH-105212</td>
<td>CAE-Workshop</td>
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<td>Albers</td>
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<td>Digital Control</td>
<td>4 CR</td>
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<td>4 CR</td>
<td>Thomas</td>
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<td>Machine Dynamics</td>
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<td>Machine Dynamics II</td>
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<td>Mechanics in Microtechnology</td>
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<td>Measurement II</td>
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<td>Microenergy Technologies</td>
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<td>T-MACH-108809</td>
<td>Micro- and nanosystem integration for medical, fluidic and optical applications</td>
<td>4 CR</td>
<td>Gengenbach, Hagenmeyer, Koker, Sieber</td>
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<td>T-MACH-102152</td>
<td>Novel Actuators and Sensors</td>
<td>4 CR</td>
<td>Kohl, Sommer</td>
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<tr>
<td>T-MACH-105442</td>
<td>Intellectual Property Rights and Strategies in Industrial Companies</td>
<td>4 CR</td>
<td>Zacharias</td>
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<td>T-MACH-105347</td>
<td>Project Management in Global Product Engineering Structures</td>
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<td>T-MACH-108889</td>
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<td>Human-Machine-Interaction</td>
<td>6 CR</td>
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<td>Signals and Systems</td>
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### Election block: Mechatronik (P) (at most 4 credits)

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<tbody>
<tr>
<td>T-MACH-105370</td>
<td>Laboratory Mechatronics</td>
<td>4 CR</td>
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<tr>
<td>T-MACH-108878</td>
<td>Laboratory Production Metrology</td>
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<td>Häfner</td>
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<td>T-MACH-102149</td>
<td>Virtual Reality Practical Course</td>
<td>4 CR</td>
<td>Ovtcharova</td>
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</table>
Competence Goal
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

Content
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.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
The contents of this major field are taught in form of lectures, exercises and practical experiences.
## 2.20 Module: Major Field: Modeling and Simulation in Dynamics (SP 61) [M-MACH-104430]

**Responsible:** Prof. Dr.-Ing. Wolfgang Seemann  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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### Election block: Modellbildung und Simulation in der Dynamik (K) (at least 8 credits)

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<tr>
<td>T-MACH-105226</td>
<td>Dynamics of the Automotive Drive Train</td>
<td>5 CR</td>
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### Election block: Modellbildung und Simulation in der Dynamik (E) ()

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<td>Atomic Simulations and Molecular Dynamics</td>
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<tr>
<td>T-MACH-105294</td>
<td>Mathematical Methods of Vibration Theory</td>
<td>5 CR</td>
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<tr>
<td>T-MACH-105172</td>
<td>Simulation of Coupled Systems</td>
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<td>Simulation of Coupled Systems - Advance</td>
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### Competence Certificate

oral examination

### Prerequisites

None

### Content

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.
## Module: Major Field: Powertrain Systems (SP 02) [M-MACH-102812]

### Responsible:
Prof. Dr.-Ing. Albert Albers

### Organisation:
KIT Department of Mechanical Engineering

### Part of:
Specialization in Mechanical Engineering (Schwerpunkt)

### Credits
12

### Recurrence
Once

### Level
3

### Version
1

### Election block: Antriebssysteme (K) (at least 8 credits)

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<td>Drive Train of Mobile Machines</td>
<td>4 CR</td>
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<td>T-MACH-105233</td>
<td>Powertrain Systems Technology A: Automotive Systems</td>
<td>4 CR</td>
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<td>T-MACH-105216</td>
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### Election block: Antriebssysteme (E) I

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<tr>
<td>T-MACH-105536</td>
<td>Dimensioning and Optimization of Power Train System</td>
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<td>Introduction into the Multi-Body Dynamics</td>
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<td>Seemann</td>
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<td>T-MACH-105151</td>
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<td>Hybrid and Electric Vehicles</td>
<td>4 CR</td>
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<td>Leadership and Management Development</td>
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<td>Machine Dynamics II</td>
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<td>Proppe</td>
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<td>Novel Actuators and Sensors</td>
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<td>Control Technology</td>
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<td>T-MACH-105358</td>
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<td>Ziegahn</td>
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<td>T-MACH-105531</td>
<td>Tribology</td>
<td>8 CR</td>
<td>Dienwiebel, Scherge</td>
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<td>T-MACH-102194</td>
<td>Combustion Engines I</td>
<td>4 CR</td>
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<td>T-MACH-102140</td>
<td>Failure of Structural Materials: Deformation and Fracture</td>
<td>4 CR</td>
<td>Gumbsch, Weygand</td>
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<td>Exercices - Tribology</td>
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### 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

### Workload
The work load is about 360 hours, corresponding to 12 credit points.

### Learning type
lectures
auditorium exercises
workshops
2.22 Module: Major Field: Production Engineering (SP 52) [M-MACH-102644]

Responsible:  Prof. Dr.-Ing. Gisela Lanza
Organisation:  KIT Department of Mechanical Engineering

Part of:  Specialization in Mechanical Engineering (Schwerpunkt)

<table>
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Election block: Production Engineering (K) (at least 8 credits)

- T-MACH-106731  Global Production Engineering (MEI)  4 CR  Lanza
- T-MACH-105379  Global Logistics  4 CR  Furmans

Election block: Production Engineering (E) ()

- T-MACH-106732  Automated Production Systems (MEI)  4 CR  Fleischer
- T-MACH-106733  SmartFactory@Industry (MEI)  4 CR  Lanza

Competence Certificate

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

Competence Goal
After completion of this module, the students are able

- to analyse and solve planning and layout problems on the level of the enterprise, production, processes and work tasks,
- to plan and control a production,
- to evaluate and configure the quality and efficiency of production, processes and products.

Prerequisites
none

Content
The students acquire in the compulsory core subjects profound knowledge about the scientific theories, principles and methods of Production Engineering. Afterwards they are able to evaluate and design complex production systems according to problems of manufacturing and process technologies, materials handling, handling techniques, information engineering as well as production organisation and management.

Workload
The work load is about 360 hours, corresponding to 12 credit points.

Learning type
Lectures, seminars, workshops, excursions
2.23 Module: Major Field: Production Systems (SP 38) [M-MACH-102589]

**Responsible:** Prof. Dr.-Ing. Volker Schulze  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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**Election block: Produktionssysteme (K) (at least 8 credits)**

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<td>Human Factors Engineering I</td>
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<td>T-MACH-105519</td>
<td>Human Factors Engineering II</td>
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<td>T-MACH-102105</td>
<td>Manufacturing Technology</td>
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<td>Schulze, Zanger</td>
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<td>T-MACH-108849</td>
<td>Integrated Production Planning in the Age of Industry 4.0</td>
<td>8</td>
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<td>T-MACH-102151</td>
<td>Material Flow in Logistic Systems</td>
<td>6</td>
<td>Furmans</td>
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<td>T-MACH-109055</td>
<td>Machine Tools and Industrial Handling</td>
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**Election block: Produktionssysteme (E) ()**

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<td>Automated Manufacturing Systems</td>
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<td>T-MACH-105227</td>
<td>Design Project Machine Tools and Industrial Handling</td>
<td>4</td>
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<td>T-MACH-105165</td>
<td>Automotive Logistics</td>
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<td>T-MACH-105147</td>
<td>Product Lifecycle Management</td>
<td>4</td>
<td>Ovtcharova</td>
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<td>Quality Management</td>
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<td>Integrated Information Systems for Engineers</td>
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**Election block: Produktionssysteme (P) (at most 4 credits)**

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<td>T-MACH-108878</td>
<td>Laboratory Production Metrology</td>
<td>4</td>
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**Competence Certificate**

- Oral exams: duration approx. 5 min per credit point
- Written exams: duration approx. 20 - 25 min per credit point

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

**Competence Goal**

The students...

- are able to choose methods of production science target-oriented in familiar situations and are able to justify their selection.
- are able to describe and compare production processes exemplarily.
- are able to transfer known solutions to given problems 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 results of others at the solution of given problems.
- have the ability to present their own results in written form and are able to interpret them.
- 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 360 hours, corresponding to 12 credit points.
Learning type
Lectures, seminars, workshops, excursions
2.24 Module: Major Field: Rail System Technology (SP 50) [M-MACH-102638]

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

**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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**Mandatory**

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<td>Rail Vehicle Technology</td>
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**Election block: Bahnsystemtechnik (E)**

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<td>Railways in the Transportation Market</td>
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<td>Electric Rail Vehicles</td>
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<td>T-MACH-105237</td>
<td>Vehicle Lightweight Design - Strategies, Concepts, Materials</td>
<td>4 CR</td>
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<td>Automotive Vision</td>
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<td>Project Management in Rail Industry</td>
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<td>T-MACH-105350</td>
<td>Computational Vehicle Dynamics</td>
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**Competence Certificate**

Oral exams: duration approx. 5 minutes per credit point.  
However, amount, type and scope of the success control can vary according the individual 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 and 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 judge 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
15. History (optional)
16. Further contents in supplementary lectures

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

Workload

- Total effort at 12 ECTS (B.Sc.): about 360 hours
- Regular attendance: 63 hours
- Self-study: 63 hours
- Exam and preparation: 234 hours

Learning type

Lectures in the core part.

Lectures and seminars are offered in the supplementary part.
Module: Major Field: Technical Logistics (SP 44) [M-MACH-102821]

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

Part of: Specialization in Mechanical Engineering (Schwerpunkt)

Mandatory

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**T-MACH-102163** Basics of Technical Logistics
6 CR  Mittwollen, Oellerich

**Election block: Technische Logistik (K) (at least 2 credits)**

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**T-MACH-102160** Selected Applications of Technical Logistics

**T-MACH-102159** Elements and Systems of Technical Logistics

**T-MACH-108946** Elements and Systems of Technical Logistics - Project

**T-MACH-108945** Selected Applications of Technical Logistics - Project

**Election block: Technische Logistik (E) (at most 1 item)**

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**T-MACH-108844** Automated Manufacturing Systems

**T-MACH-105151** Energy Efficient Intralogistic Systems

**T-MACH-105378** Cognitive Automobiles - Laboratory

**T-MACH-105174** Warehousing and Distribution Systems

**T-MACH-102151** Material Flow in Logistic Systems

**T-WIWI-103091** Production and Logistics Controlling

**T-MACH-102107** Quality Management

**T-MACH-105171** Safety Engineering

**T-MACH-105367** Behaviour Generation for Vehicles

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

**Annotation**

If LV 2117095 (basics of technical logistics) has been already examined successfully outside this emphasis module, another lecture from core-section can be chosen.

**Workload**

The work load is about 360 hours, corresponding to 12 credit points.

**Learning type**

Lectures and practices; self-study
### Module: Major Field: Vehicle Technology (SP 12) [M-MACH-102818]

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

**Part of:** Specialization in Mechanical Engineering (Schwerpunkt)

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<td><strong>T-MACH-105655</strong> Alternative Powertrain for Automobiles</td>
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<td><strong>T-MACH-105233</strong> Powertrain Systems Technology A: Automotive Systems</td>
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<td><strong>T-MACH-105536</strong> Dimensioning and Optimization of Power Train System</td>
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<td><strong>T-MACH-105226</strong> Dynamics of the Automotive Drive Train</td>
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<td><strong>T-MACH-105152</strong> Handling Characteristics of Motor Vehicles I</td>
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<td><strong>T-MACH-105153</strong> Handling Characteristics of Motor Vehicles II</td>
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<td><strong>T-MACH-108374</strong> Vehicle Ergonomics</td>
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<td><strong>T-MACH-105155</strong> Vehicle Comfort and Acoustics II</td>
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<td><strong>T-MACH-105156</strong> Vehicle Mechatronics I</td>
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<td><strong>T-MACH-102116</strong> Fundamentals for Design of Motor-Vehicle Bodies I</td>
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<td><strong>T-MACH-102119</strong> Fundamentals for Design of Motor-Vehicle Bodies II</td>
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<td><strong>T-MACH-105161</strong> Fundamentals in the Development of Commercial Vehicles II</td>
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<td><strong>T-MACH-105162</strong> Fundamentals of Automobile Development I</td>
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<td><strong>T-MACH-105166</strong> Materials and Processes for Body Lightweight Construction in the Automotive Industry</td>
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<td><strong>T-MACH-105442</strong> Intellectual Property Rights and Strategies in Industrial Companies</td>
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<td><strong>T-MACH-102155</strong> Product, Process and Resource Integration in the Automotive Industry</td>
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<td><strong>T-MACH-102156</strong> Project Workshop: Automotive Engineering</td>
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<tr>
<td><strong>T-MACH-105441</strong> Development of Oil-Hydraulic Powertrain Systems</td>
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### Competence Certificate
Valid for all degree programmes, for which no value is indicated in the following.

The assessment is carried out as partial exams of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. Amount, type and scope of the success controll can vary according to the individually choice. Oral exams: duration approx. 5 min. per credit point. Within the scope of lab courses maximum 4 credits may be acquired.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

### 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
In the module Automotive Technology the basics are taught, which are important for the development, the design, the production and the operation of vehicles. Particularly the primary important aggregates like engine, gear, drive train, chasis and auxiliary equipment are explained, but also all technical equipment, which make the operation safer and easier. Additionally the interior equipment is examined, which shall provide a preferably comfortable, optimum ambience to the user.

In the module Automotive Technology the focus is on passenger cars and commercial vehicles, which are designed for road applications.

### Workload
The work load is about 360 hours, corresponding to 12 credit points.

### Learning type
The teaching and learning procedures (lecture, lab course, workshop) are described for each course of the module separately.

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<td>Project Management in Global Product Engineering Structures</td>
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<td>Computational Vehicle Dynamics</td>
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<td>Strategic product development - identification of potentials of innovative products</td>
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<td>T-MACH-105358</td>
<td>Sustainable Product Engineering</td>
<td>4 CR</td>
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<td>T-MACH-102194</td>
<td>Combustion Engines I</td>
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<td>Koch, Kubach</td>
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<td>Gear Cutting Technology</td>
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Module: Major Field: Vibration Theory [M-MACH-104442]

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

Part of: Specialization in Mechanical Engineering (Schwerpunkt)

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<td>Machine Dynamics</td>
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<td>T-MACH-105294</td>
<td>Mathematical Methods of Vibration Theory</td>
<td>5 CR</td>
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<td>Theory of Stability</td>
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<td>T-MACH-105439</td>
<td>Introduction to Nonlinear Vibrations</td>
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Election block: Schwingungslehre (E) (at most 1 item)

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<td>T-MACH-105154</td>
<td>Vehicle Comfort and Acoustics I</td>
<td>4 CR</td>
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<td>T-MACH-105349</td>
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Election block: Schwingungslehre (P) (at most 4 credits)

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<td>T-MACH-105373</td>
<td>Practical Training in Measurement of Vibrations</td>
<td>4 CR</td>
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Competence Certificate
oral examination

Prerequisites
None

Content
The students know different methods which may be applied for the analysis of investigation of vibration problems. They are able to treat one or multiple degree 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.
Module: Manufacturing Processes [M-MACH-102549]

**Responsible:** Prof. Dr.-Ing. Volker Schulze  
Dr.-Ing. Frederik Zanger  

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Fundamentals of Engineering

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**Mandatory**

| T-MACH-105219 | Basics of Manufacturing Technology | 4 CR | Schulze, Zanger |

**Competence Certificate**

written exam (duration: 60 min)

**Competence Goal**

The students …

- are able to classify the manufacturing processes by their general functionality according to the specific main groups (DIN 8580).  
- have the ability to declare and explain the function of the significant manufacturing processes of the main groups (DIN 8580).  
- are enabled to describe the characteristic process features (geometry, materials, accuracy, tools, machines) of the significant manufacturing processes of the main groups (DIN 8580).  
- have the ability to derive the relevant process specific technical advantages and disadvantages of the characteristic process features.  
- are enabled to perform a selection of suitable manufacturing processes for given components.  
- are enabled to classify the required manufacturing processes in the expiry of a process chain for the production of given sample products.

**Prerequisites**

none

**Content**

The objective of the lecture is to classify the manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to establish basic process knowledge of the common processes. The lecture conveys the basic principles of manufacturing technology and deals with the manufacturing processes based on example components according to their classification into main groups regarding technical and economic aspects.

The following topics will be covered:

- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)  
- Forming (sheet-metal forming, massive forming)  
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)  
- Joining  
- Coating  
- Heat treatment and surface treatment

**Workload**

regular attendance: 21 hours  
self-study: 99 hours

**Learning type**

Lecture
2.29 Module: Materials Science (BSc-Modul 04, WK) [M-MACH-102562]

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

Credits | Duration | Language | Level | Version
--- | --- | --- | --- | ---
14 | 2 term | Deutsch/Englisch | 3 | 2

Mandatory

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Competence Certificate

not graded: participation in 10 lab experiments, introductory colloquia must be passed and 1 short presentation must be presented. The lab course must be finished successfully prior to the registration for the oral exam;

graded: oral exam covering the whole module, about 25 minutes.

Competence Goal

Within this Module the students should

- gain knowledge of basics about structural and functional materials
- be able to draw relationships between atomic structure, microstructure and properties
- be able to apply appropriate methods to determine mechanical and other relevant properties as well as to characterize the microstructure of materials
- be able to assess material properties and corresponding applications

Prerequisites

none

Content

WK I

Structure of atoms and atomic bonding
Crystalline solids
Defects in crystalline solids
Amorphous and partially crystalline solids
Constitution of alloys and materials
Diffusion and phase transformation in the solid state
Microscopic characterization method
Characterization with X-Rays and neutrons
Non-destructive Testing
Mechanical Testing
WK II

Iron based alloys
Non-iron based alloys
Ceramics
Glases
Polymers
Composite Materials
**Annotation**
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

**Workload**
The workload of the module is about 420 hours.

The workload for the lab course Materials Science is 90 h in total and consists of the presence during the 10 experiments (one week half-time, 4 hours per day) as well as preparation and rework time at home.

The workload for the lecture Materials Science I & II is 165 h per semester and consists of the presence during the lectures (WS: 4 SWS, SS: 2SWS) and the exercises (1 SWS per WS and 1 SWS per SS) as well as preparation and rework time at home.

**Learning type**
The module "Materials Science" consists of the lectures "Materials Science I and II" with additional tutorials for small groups and a one week materials science laboratory course.
2.30 Module: Measurement and Control Systems (BSc-Modul 11, MRT) [M-MACH-102564]

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

Part of: Fundamentals of Engineering

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Mandatory

| T-MACH-104745 | Basics in Measurement and Control Systems | 7 CR | Stiller |

Competence Certificate
Type of Examination: written exam
Duration of Examination: 150 minutes

Competence Goal

- Students are able to name, describe and explain control principles applied to physical quantities.
- They are able to name, analyze and assess system theoretic characteristics of dynamical systems.
- Students are able to represent real systems in a system theoretic model and to assess the suitability of a given model.
- Students are able to apply methods for controller design and to analyze their properties.
- Students are able to select appropriate principles of metrology and to model, analyze and assess measurement setups.
- Students are able to quantify and assess measurement uncertainties.

Module grade calculation
result of exam

Prerequisites
none

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

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
84 hours presence time, 126 hours selfstudies

Learning type
Lecture
Tutorials
Module: Mechanical Design (BSc-Modul 06, MKL) [M-MACH-102573]

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

Part of: Fundamentals of Engineering

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<td>T-MACH-105285</td>
<td>Mechanical Design IV, Constructing the Team</td>
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Albers, Burkardt, Matthiesen

Competence Certificate
Mechanical Design I & II:
Preliminary examination: Successful participation in workshops in the field of mechanical Design I, as well as successful processing of output power in mechanical design II
Written examination in the field of mechanical engineering I and II: duration 60 min plus reading time

Mechanical Design III & IV:
Preliminary examination: Successful participation in workshops in the field of mechanical Design III & IV

- Examination in the field of mechanical Design III & IV consisting of written part with duration 60 min plus reading time and
- constructive part with duration 180 min plus reading time
Competence Goal

Learning object springs:

- be able to recognize spring types and explain stress
- Identify and describe the properties of a resilient LSS in machine elements presented later on
- Understanding and explaining the principle of action
- Know and list areas of application for springs
- graphically illustrate the load and the resulting stresses
- be able to describe the degree of species usefulness as a means of lightweight construction
- be able to analyse different solution variants with regard to lightweight construction (use species efficiency)
- Being able to explain several springs as a circuit and calculate total spring stiffness

Learning objects Technical Systems:

- Being able to explain what a technical system is
- "Thinking in systems."
- Using system technology as an abstraction tool for handling complexity
- Recognizing functional relationships of technical systems
- Getting to know the concept of function
- be able to use C&C²-A as a means of system technology

Learning objects Visualization:

- Ability to create and interpret schematics
- Using freehand technical drawing as a means of communication
- To be able to apply the technical basics of freehand drawing
- Derivation of 2D representations into different perspective representations of technical structures and vice versa
- Master reading of technical drawings
- Dedicated dimensioning of technical drawings
- Create sectional views of technical systems as a technical sketch

Learning objects Bearings:

- be able to recognize bearings in machine systems and explain their basic functions
- name bearings (type/type/function) and recognize them in machine systems and technical drawings
- Being able to name areas of application and selection criteria for the various bearings and bearing arrangements and explain interrelationships
- Ability to functionally explain the design of the bearing definitions in different directions radially/axially and circumferentially
- Know and describe selection as an iterative process as an example
- be able to perform dimensioning of bearing arrangements as an example of the engineer’s approach to dimensioning machine elements
- Develop first ideas for probabilities in predicting the life of machine elements
- Recognise from the damage pattern whether static or dynamic overload was the cause of material failure
- Calculate equivalent static and dynamic bearing loads from the catalogue and given external forces on the bearing
- Being able to name, explain and transfer the basic equation of the dimensioning to the bearing dimensioning

Learning objectives seals:

The students...

- can discuss the basic functions of seals
- can describe the physical causes for mass transfer
- can apply the C&C-Model on seals
- can name, describe and apply the three most important classification criteria of seals
- can explain the function of a contacting seal and a non-contacting seal.
- can differentiate the seal types and organize them to the classification criteria.
- can discuss the structure and the effect of a radial shaft seal
- can evaluate radial shaft seals, compression packings, mechanical seals, gap seals and labyrinth seals
- can describe and apply the constructional principle of selffortification
- can describe the stick-slip phenomenon during the movement sequences of a reciprocating seal

Learning design:

The students...

- understand the meaning of design
- are able to recognize and implement basic rules and principles of design
- are able to design the connection of partial systems into the total system
- can name requirements of design and take them into account
- know the main groups of manufacturing methods
- are able to explain the manufacturing processes
- are able to depict a casted design in a drawing clearly, e.g. draft of the mold, no material accumulation, …
- know how components are designed
Know how the production of the components has an effect on their design

Know the requirements and boundary conditions on design

Learning bolted connections:
The students...

- can list and explain various bolt applications.
- can recognize bolt types and explain their function
- can build a C&C² model of a bolted joint and discuss the influences on its function
- can explain the function of a bolted connection with the help of a spring model
- can reproduce, apply and discuss the screw equation.
- Can estimate the load-bearing capacity of low-loaded bolted joints for dimensioning purposes
- Can indicate which bolted joint is to be calculated and which only roughly dimensioned.
- Can carry out the dimensioning of bolted connections as flange connections
- Can create, explain and discuss the force deflection diagram of a bolted connection

Learning objectives tolerances and fits:
The students...

- know the importance of the microstructure of working surfaces on technical surfaces on the function. They are familiar with a system for describing the surface microstructure in technology and parameters for describing the surface fine structure of working surfaces both in their definition and in their statement and in the quantitative order of magnitude.
- know and can explain surface measurement principles.
- know the relationship between the surface structure and the manufacturing processes and the costs.
- know the purpose of standards, standard types and preferred numbers.
- know and can define tolerances as a description of the geometry of working surfaces. They know the ISO fitting systems in type and structure and can apply it.
- can explain the different types of toleration and their significance for the economic product development process.

Learning objectives component connections:
The students...

- can generally explain basic functions of shaft-hub-connections.
- know and can explain a selection of different component connections to the respective working principles.
- can explain the component connection "centering" in its function and draw it in a technical drawing.
- understand form-closing and force-closing shaft-hub connections and can explain them. They can dimension a cylindrical interference fit (calculation and dimensioning criteria) and understand the stresses on a cylindrical interference fit and can display them graphically.

Learning objectives gears:
The students...

- Understand the function of gearboxes in the context of drive systems.
- are familiar with different operating principles of gearboxes and different types of gearboxes.
- know and understand the law of gearing. They know names on the gear and different flank curves.
- Understand engagement of gears, application limits and damage to gears. They know the basic ideas of gear dimensioning.
- know and understand planetary gearboxes. They understand the operating principle of hydraulic transmissions.

Learning objects dimensioning

Students can...

- Explain the target values of the economic dimensioning
- explain what are the main results of a dimensioning process
- explain the scope of the dimensioning (economic and legal significance)
- Explain the basic sizing procedure and record it as a generic flowchart
- Explain uncertainties in dimensioning
- specify the different basic procedures, both for dimensioning and for determining the influencing variables, e.g. loads, as well as their advantages or disadvantages in relation to each other
- explain different types of calculation methods and their characteristics (static/dynamic, local vs. nominal voltages)
- Name different types of failure (implies the definition of failure)
- Explain possible causes of failure
- provide suitable replacement models for simple subsystems of technical systems as a basis for dimensioning
- Explain different basic load types for given examples Dominant load types relevant to design
- Use the basics of elastostatics for all basic load cases to design components that can be modeled as linear structures according to the nominal stress concept.
- describe the dimensioning parameters presented in the VL and their use (shape number, shape yield strength, shape yield strength ratio)
- explain the purpose of strength hypotheses
• explain the strength hypotheses for metallic materials presented in the VL and select them according to the specific situation
• explain the principal effects of notches, including the factors affecting the magnitude of these effects
• describe how notches can be taken into account in the dimensioning process
• notched components that can be modeled as linear load-bearing structures for static loads
• Explain possibilities for determining the strength of a material or component
• Name influencing variables on the loadability and derive measures from them in order to influence the loadability of a component if necessary.
• describe different types of material behaviour under overelastic stressing of metallic materials
• Describe dynamic loads
• from Wöhler, Haigh- or Smith diagrams determine material characteristics for the loadability under given load conditions
• construct the Smith chart approximately with the given characteristic values
• explain the difference between strength and fatigue strength
• Components that can be modeled as linear structures according to the nominal stress concept for dynamic loads in base load cases and combined loads in the same phase
• for components that can be modeled as linear structures, explain the design approach presented in the lecture for any combined, dynamic loads
• Perform strength analyses in accordance with DIN 743, in the course of which even failure-critical points in the component can be identified and, if the result is negative, appropriate measures can be derived and evaluated.
• Name factors influencing the safety factors to be selected and explain what type of influence this is

Learning objectives shaft couplings:

Students can...

• Name the reasons for using shaft couplings (in short: "Couplings")
• name exemplary applications of couplings
• List basic functions of clutches and delimit clutches to transmissions
• indicate the basic power balance of a coupling
• mention various ancillary functions that occur with clutches
• name various criteria for classifying couplings
• describe the embodiment-function relationship for a given coupling for both main and secondary functions
• If necessary, derive the main and auxiliary functions required for the application, select a suitable coupling (and if necessary also a specific size) or combine several couplings if necessary.
• Explain interactions of couplings with adjacent subsystems, possibly specific to certain designs or groups of couplings
• Specify selection criteria for couplings
• explain central design principles for different groups of couplings, including the designation of key design targets
• for frictionally engageable clutches, slip time, transferable torque and thermal resistance should be designed roughly under the assumptions and simplifications dealt with in the lecture, estimate the relevant loads by the surrounding technical system and, if necessary, influence the specified target values by design measures.
• Apply relevant standards for the design of couplings
• Name possible failure modes for given couplings
• specify which design measures on a coupling can be used to influence the dynamic behaviour of the surrounding system in a desired direction
• explain the various possible actuation types for switchable clutches and give examples of corresponding clutch designs

Learning Objectives Fundamentals of Fluid Technology:

Students can...

• differentiate between different areas of fluid technology on the basis of essential aspects of the operating principles
• Identify properties/ special features of fluid technology systems and the resulting areas of application
• explain basic approaches for the design of hydraulic systems
• differentiate the flow types shown in the lecture
• with the basic equations (continuity equation, Bernoulli,...) of hydrostatics and hydrodynamics explained in the lecture.
• Identify sources of pressure losses in hydraulic systems and influencing factors
• designate basic subsystems of a hydraulic system
• Assign system and component examples shown in the lecture to components of a hydraulic system
• name the symbols shown in the lecture and assign them to the respective system/component
• use symbols to explain the function of simple hydraulic systems
• Draw up function diagrams for hydraulic systems that are similar in complexity to the systems shown in the lecture.

Prerequisites

None
Content

MKL I:
Introduction to mechanical design
Tools for visualization (technical drawing)
Product Development as a problem solution
Technical Systems Product Development

• Systems theory
• Contact and Channel Approach C&C²-A

Basics of selected construction and machine elements

• springs
• Bearing and fence

The lecture is accompanied by exercises with the following content:
gear workshop
Exercises for visualization tools (technical drawing)
Exercise on Technical Systems Product Creation

• Systems theory
• Contact and Channel Approach C&C²-A

Exercise on the spring module
Exercise on the bearing and fence Module

MKL II:

• Basics bearings
• Sealings
• Design
• Tolerances and fits
• component connections
• The lecture is accompanied by exercises to deepen the contents of the lecture.

MKL III:

• component connections
• tolerances and fits
• gears

MKL IV:
Elementary component connections - Part 2

Basics of clutches

• Function and operating principles
• Characteristic features and classification
• Non-engaging shaft clutches
• Switchable shaft clutches
• Flexible clutches

Basics of gearboxs

• Function and operating principles
• Basics of gear drives
• Characteristic features and classification
• selection criteria
• Basics of other transmissions
• Fundamentals of lubrication and lubricants

Basics of gearing

• Function and operating principles
• Types of thoothing
• Cycloid as flank curve
• Involute as flank curve
• Method of manufacturing gears
• Profil overlap
• Profil offset
• Limits of application and damage
• Dimensioning
• Tooth strength
• Pitting resistance

**Basics of hydraulics**

• Basic functions and operating principles
• Characteristic features and classification
• Types and properties
• Sample
• Application
• Design calculation

**Annotation**

For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

**Workload**

**MKL 1:**
Attendance at lectures (15 VL): 22.5h
Presence exercises (8 exercises): 12h
Attendance (3x 2h) and preparation (3x3h) Workshop sessions: 15h
Preparation and execution of online test: 6h
Personal preparation and follow-up of lecture and exercise: 34.5h

**MKL 2:**
Attendance lectures (15 VL): 22.5h
Presence exercises (7 ÜB): 10.5h
Personal preparation and follow-up of lecture and exercise, incl. prerequisite and preparation for the exam:: 117h

**MKL 3:**
Attendance lectures (15 L): 22.5h
Presence exercises (4 exercises): 6h
Attendance milestones project work (3x 4h): 12h
Project work in a team: 80h
Personal preparation and follow-up of lecture and exercise: 29.5h

**MKL 4:**
Attendance lectures (13 L): 19.5h
Presence exercises (6 exercises): 9h
Attendance milestones project work (3x 4h): 12h
Project work in a team: 120h
Personal preparation and follow-up of lecture and exercise, incl. preparation for the exam: 82.5h

**Learning type**

Lecture
Tutorial
Project work during the semester
### 2.32 Module: Orientation Exam [M-MACH-104624]

**Organisation:** University  
**Part of:** Orientation Exam

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<td>Arens, Griesmaier, Hettlich</td>
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**Modelled deadline**  
This module must be passed until the end of the 3. term.
Module: Physics [M-PHYS-104030]

Responsible: Prof. Dr. Gernot Goll
Prof. Dr. Bernd Pilawa

Organisation: KIT Department of Physics
Part of: Fundamentals of Engineering

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<td>T-PHYS-108322</td>
<td>Wave and Quantum Physics</td>
<td>5 CR Goll, Pilawa</td>
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Competence Certificate
The assessment consists of a written exam according to Section 4(2), 1 of the examination regulation.

Competence Goal
The students

- are familiar with the properties of waves and can discuss those
- can reflect on the principles of relativity
- comprehend the coherence of the particle and wave description of light and matter
- can explain the limits of wave physics
- are able to apply the Schrödinger-equation to basic problems in quantum mechanics
- can explain the basic properties of atoms, especially for the hydrogen atom
- can discuss fundamental aspects of the electronic properties of solids

Prerequisites
None

Content

- Properties of waves
- Acoustic and electromagnetic waves
- Interference and diffraction
- Relativity
- Wave-particle dualism
- Basic properties of atoms
- Basic electronic properties of solids

Annotation
For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

Workload
150 hours, consisting of attendance times (45), follow-up of the lecture including exam preparation and preparation of exercises (105)

Learning type
Lecture and Tutorial
Module: Production Operations Management [M-MACH-100297]

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

**Part of:** Fundamentals of Engineering

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<tr>
<td>T-MACH-108734</td>
<td>Production Operations Management-Project</td>
<td>2 CR</td>
<td>Furmans, Lanza</td>
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**Competence Certificate**

The success control takes place in the form of partial examinations in the individual courses of the module. These are a written exam (duration: 90 minutes) and a different type of examination. The module grade is made up of the grades of the courses in the module weighted by credit points.

**Competence Goal**

If you successfully passed this course you will be able to:

- state the relevant technical terms of business administration, logistics and production engineering  
- describe the interrelation between these technical terms  
- describe the most important decision problems qualitatively and quantitatively  
- apply the appropriate decision models to solve the respective decision problems  
- critically evaluate the results and draw appropriate conclusions  
- extend the learned methods and models by researching on your own

**Prerequisites**

none

**Content**

The institutes alternate with each cycle. Basic skills about the planning and operation of a production plant are taught. The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms.

**Annotation**

It is a joint module of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK).

For the Bachelor's program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor's program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.

**Workload**

Attendance time: 42 hours,  
Self-study: 108 hours

**Learning type**

1. Lectures (Obligatory)  
2. Tutorials (Obligatory)  
3. Group work (Obligatory)  
4. Oral defense of the group work (Obligatory)
2.35 Module: Technical Thermodynamics (BSc-Modul 05, TTD) [M-MACH-102574]

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

**Part of:** Fundamentals of Engineering

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**Competence Certificate**

Prerequisite: attestation each semester by homework assignments  
Thermodynamics I: Written exam, graded, 3 hours  
Thermodynamics II: Written exam, graded, 3 hours

**Competence Goal**

The students acquire the competency to master the fundamentals of thermodynamics and the ability to apply the knowledge an problem-solving in various branches of mechanical engineering and especially in the Energy Technology sector.

An integral part of the model is that students can define the fundamental laws of thermodynamics and their application. The students are competent in describing and comparing the main processes in energy conversion. Using tools also applied in Industry they are capable of analysing and rating the efficiency of processes. The students are capable of discussing the thermodynamical correlation of ideal gas mixtures, real gases and of humid air as well analysing them with the help of the laws of thermodynamic. Furthermore the students are capable of defining and applying the heattransfer mechanisms.

**Module grade calculation**

weight according to CP

**Prerequisites**

None

**Content**

Thermodynamics I:

- System, properties of state  
- Chemical and thermodynamic properties of pure components  
- Absolute temperature, model systems  
- 1st law of thermodynamics for resting and moved systems Entropy and 2nd law of thermodynamics  
- Behavior of real substances described by tables, diagrams and equations of state  
- Machine processes

Thermodynamics II:

- Repetition of the topics of “Thermodynamics and Heat Transfer I”  
- Mixtures of ideal gases  
- Moist air  
- Behaviour of real substances described by equations of state  
- Applications of the laws of thermodynamics to chemical reactions

**Annotation**

For the Bachelor’s program Mechanical Engineering the module (including all brick details, exams and courses) is offered in German.

For the Bachelor’s program Mechanical Engineering (International) the module (including all brick details, exams and courses) is offered in English.
Workload
lectures and exercises: 150h
homework and preparation of examination: 300h

Learning type
Lecture
Exercise course
Tutorial
3 Courses

3.1 Course: Advanced Mathematics I [T-MATH-100275]

**Responsible:** PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics  
Part of: M-MACH-104624 - Orientierungsprüfung  
M-MATH-102859 - Höhere Mathematik

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**Competence Certificate**  
Learning assessment is carried out by written examination of 120 minutes length.

**Prerequisites**  
A "pass" result on the pre-requisite in AM I is a requirement for registration for the examination in AM I.

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

1. The course **T-MATH-100525 - Tutorial Advanced Mathematics I** must have been passed.
3.2 Course: Advanced Mathematics II [T-MATH-100276]

**Responsible:**  
PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102859 - Höhere Mathematik

| Events | | | | |
| --- | --- | --- | --- | |
| SS 2018 | 0120010 | Advanced Mathematics II | 4 SWS | Lecture (V) | Thäter |
| SS 2018 | 0180800 | Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik | 4 SWS | Lecture (V) | Arens |
| SS 2018 | 0181000 | Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT | 4 SWS | Lecture (V) | Arens |

| Exams | | | | |
| --- | --- | --- | --- | |
| SS 2018 | 6700001 | Advanced Mathematics II | Prüfung (PR) | Kirsch, Arens, Hettlich |
| SS 2018 | 6700032 | Advanced Mathematics II (English Class) | Prüfung (PR) | Arens, Aksenovich, Kirsch |
| WS 18/19 | 6700008 | Advanced Mathematics II | Prüfung (PR) | Arens, Kirsch, Hettlich |

**Competence Certificate**  
Learning assessment is carried out by written examination of 120 minutes length.

**Prerequisites**  
A "pass" result on the pre-requisite in AM II is a requirement for registration for the examination in AM II.

**Modeled Conditions**  
The following conditions have to be fulfilled:  
1. The course T-MATH-100526 - Tutorial Advanced Mathematics II must have been passed.
3.3 Course: Advanced Mathematics III [T-MATH-100277]

Responsible: PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics
Part of: M-MATH-102859 - Höhere Mathematik

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Competence Certificate

Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites

A "pass" result on the pre-requisite in AM III is a requirement for registration for the examination in AM III.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MATH-100527 - Tutorial Advanced Mathematics III must have been passed.
3.4 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-102582 - Schwerpunkt: Kontinuumsmechanik

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**Competence Certificate**

Written examination (90 min). Additives as announced

**Prerequisites**

None

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

**Advanced Methods in Strength of Materials**

2161252, WS 18/19, 2 SWS, Open in study portal

**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
3.5 Course: Agile product innovation management - value-driven planning of new products [T-MACH-106744]

**Responsible:** Dr.-Ing. Roland Kläger  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102583 - Schwerpunkt: Informationsmanagement

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

**Prerequisites**
None
3.6 Course: Alternative Powertrain for Automobiles [T-MACH-105655]

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

Part of: M-MACH-102645 - Schwerpunkt: Technik des Verbrennungsmotors
       M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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

**Responsible:** Dr.-Ing. Marcus Gohl  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102645 - Schwerpunkt: Technik des Verbrennungsmotors

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**Competence Certificate**

Letter of attendance or oral exam (25 minutes, no auxiliary means)

**Prerequisites**

none

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

**Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines**

2134150, SS 2018, 2 SWS, Open in study portal

**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.
3.8 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-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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

**Prerequisites**  
None

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

**Applied Tribology in Industrial Product Development**  
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.
## 3.9 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik  
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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<td>Brandl, Gumbsch</td>
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### Exams

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<th>Course Code</th>
<th>Description</th>
<th>Type</th>
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<tr>
<td>SS 2018</td>
<td>76-T-MACH-105308</td>
<td>Atomistic Simulations and Molecular Dynamics</td>
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<td>2</td>
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<td>WS 18/19</td>
<td>76-T-MACH-105308</td>
<td>Atomistic Simulations and Molecular Dynamics</td>
<td>Prüfung (PR)</td>
<td>2</td>
<td>Gumbsch</td>
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</tbody>
</table>

### Competence Certificate
oral exam ca. 30 minutes

### Prerequisites
none

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

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

### 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

Lab for 'Atomistic simulations and molecular dynamics'
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
3.10 Course: Automated Manufacturing Systems [T-MACH-102162]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102589 - Schwerpunkt: Produktionssysteme

<table>
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<td>Lecture / Practice (VÜ)</td>
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<td>Fleischer</td>
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<td>Automated Manufacturing Systems</td>
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<td>Prüfung (PR)</td>
<td>Automated Manufacturing Systems</td>
<td>Fleischer</td>
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</tbody>
</table>

**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:**

Automated Manufacturing Systems

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Lecture notes will be provided in Ilias (<a href="https://ilias.studium.kit.edu/">https://ilias.studium.kit.edu/</a>)</td>
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</table>
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
3.11 Course: Automated Manufacturing Systems [T-MACH-108844]

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

**Part of:**  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
- M-MACH-102820 - Schwerpunkt: Mechatronik  
- M-MACH-102821 - Schwerpunkt: Technische Logistik

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**Events**

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**Exams**

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<td>WS 18/19</td>
<td>6 SWS</td>
<td>Prüfung (PR)</td>
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**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:**

**Automated Manufacturing Systems**  
2150904, SS 2018, 6 SWS, Open in study portal

**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
### 3.12 Course: Automated Production Systems (MEI) [T-MACH-106732]

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

#### Part of: M-MACH-102644 - Schwerpunkt: Production Engineering

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<td>Prüfung (PR)</td>
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</table>

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

**Prerequisites**
none

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

#### Automated Production Systems (MEI)
3150012, SS 2018, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

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

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

In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components. The analysis of automated manufacturing systems for manufacturing of defined components is also included.
3.13 Course: Automation Systems [T-MACH-105217]

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

Part of: M-MACH-102820 - Schwerpunkt: Mechatronik

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Events

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<td>Automation Systems</td>
<td>Prüfung (PR)</td>
<td>Kaufmann, Hagenmeyer</td>
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<td>Automation Systems</td>
<td>Prüfung (PR)</td>
<td>Kaufmann, Hagenmeyer</td>
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</tbody>
</table>

Competence Certificate

Written exam (Duration: 1 h)

Prerequisites

none

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

**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

### 3.14 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-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

<table>
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<td>2113805</td>
<td>Lecture (V)</td>
<td>Automotive Engineering I</td>
<td>4 SWS</td>
<td>Each winter term</td>
<td>1 terms</td>
<td>Gauterin, Unrau</td>
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<td>WS 18/19</td>
<td>2113809</td>
<td>Lecture (V)</td>
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<td>Each winter term</td>
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**Exams**

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<td>Unrau, Gauterin</td>
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</table>

**Competence Certificate**

Written examination

Duration: 120 minutes

Auxiliary means: none

**Prerequisites**

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

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

### Automotive Engineering I

**2113805, WS 18/19, 4 SWS, Open in study portal**

**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**

Automotive Engineering I
2113809, WS 18/19, 4 SWS, Open in study portal

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
3.15 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Events**

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<td>Automotive Engineering II</td>
<td>2 SWS</td>
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<td>Gauterin, Unrau</td>
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</table>

**Competence Certificate**

Written Examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**

none

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

### Automotive Engineering II

**2114835, SS 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**

3. Gnadler, R. / Unrau, H.-J.: Script to the lecture 'Grundlagen der Fahrzeugtechnik II'

### 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:

3. Gnadler, R.: Skript zur Vorlesung "Grundlagen der Fahrzeugtechnik II"
3.16 Course: Automotive Logistics [T-MACH-105165]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102589 - Schwerpunkt: Produktionssysteme

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**Events**

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**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:*

**Automotive Logistics**

2118085, SS 2018, 2 SWS, Open in study portal

**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.
3.17 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-102638 - Schwerpunkt: Bahnsystemtechnik  
M-MACH-102817 - Schwerpunkt: Informationstechnik  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
M-MACH-102820 - Schwerpunkt: Mechatronik

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**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:*

**Automotive Vision**

2138340, SS 2018, 3 SWS, [Open in study portal](#)  

**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
Exams

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<td>76-T-MACH-109188</td>
<td>Bachelor Thesis</td>
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### Competence Certificate

The bachelor 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 work load of the bachelor thesis corresponds to 12 ECTS. The maximal processing time of the bachelor thesis takes three months. 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 bachelor 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 bachelor thesis is not completed in time, this examination is "failed" (5,0), unless the student is not responsible.

The bachelor 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 bachelor thesis is graded by the examination board within this assessment; another expert can be appointed too. The bachelor thesis has to be graded within a period of six weeks after the submission.

### Prerequisites

The requirement for admission to the bachelor thesis module are 120 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 120 credits in the following fields:
   - Fundamentals of Engineering
   - Interdisciplinary Qualifications
   - Specialization in Mechanical Engineering

### Annotation

The workload for the preparation of the bachelor thesis is about 360 hours.
# Course: Basics in Measurement and Control Systems [T-MACH-104745]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102564 - Mess- und Regelungstechnik

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<td>Measurement and Control Systems (Tutorial)</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
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<td>Basis of Measurement and Control Systems</td>
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**Competence Certificate**  
written exam  
2.5 hours

**Prerequisites**  
none

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

## Measurement and Control Systems

2137301, WS 18/19, 3 SWS, [Open in study portal](#)

**Lecture (V)**

**Learning Content**

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

**Workload**

210 hours
Literature

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

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

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

V Measurement and Control Systems
3137020, WS 18/19, 3 SWS, Open in study portal

Learning Content

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

Workload
180 hours

Literature

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

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

- Messtechnische Bücher:
  
  E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
  W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
  Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980
### 3.20 Course: Basics of Manufacturing Technology [T-MACH-105219]

**Responsible:** Prof. Dr.-Ing. Volker Schulze  
Dr.-Ing. Frederik Zanger  

**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-102549 - Fertigungsprozesse

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

written exam (duration: 60 min)

**Prerequisites**

none

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

**Basics of Manufacturing Technology**

2149658, WS 18/19, 2 SWS, Open in study portal

**Description**

**Media:**

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

**Learning Content**

The objective of the lecture is to classify the manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to establish basic process knowledge of the common processes. The lecture conveys the basic principles of manufacturing technology and deals with the manufacturing processes based on example components according to their classification into main groups regarding technical and economic aspects. Regard is paid to classic manufacturing processes as well as new developments like additive manufacturing processes. The following topics will be covered:

- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment

**Workload**

regular attendance: 21 hours  
self-study: 99 hours
### 3.21 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-102746 - Wahlpflichtmodul  
- M-MACH-102821 - Schwerpunkt: Technische Logistik

**Type**  
Prüfungsleistung schriftlich

**Credits**  
6

**Recurrence**  
Each winter term

**Version**  
2

### Events

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<td>Mittwollen, Oellerich</td>
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<td>Prüfung (PR)</td>
<td>Mittwollen</td>
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**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:

### 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
3.22 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-102817 - Schwerpunkt: Informationstechnik  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
M-MACH-102820 - Schwerpunkt: Mechatronik  
M-MACH-102821 - Schwerpunkt: Technische Logistik

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<tr>
<td>SS 2018 2138336</td>
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Exams

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Competence Certificate

written examination

60 min.

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

Prerequisites

none

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

Behaviour Generation for Vehicles

2138336, SS 2018, 2 SWS, Open in study portal

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
3.23 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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<td>WS 18/19</td>
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<td>Biomechanics: Design in Nature and Inspired by Nature</td>
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<td>Biomechanics: design in nature and inspired by nature</td>
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<td>Mattheck</td>
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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:

Biomechanics: Design in Nature and Inspired by Nature
2181708, WS 18/19, 3 SWS. Open in study portal

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

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102817 - Schwerpunkt: Informationstechnik
M-MACH-102820 - Schwerpunkt: Mechatronik

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<td>BUS-Controls</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
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| 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 76-T-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:

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

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

**Responsible:** Kevin Daß
Prof. Dr.-Ing. Marcus Geimer

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-102817 - Schwerpunkt: Informationstechnik
- M-MACH-102820 - Schwerpunkt: Mechatronik

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<td>BUS-Controls - Advance</td>
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</table>

**Competence Certificate**

Creation of control program

**Prerequisites**

none
### 3.26 Course: CAD-NX Training Course [T-MACH-102187]

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

**Part of:** M-MACH-102583 - Schwerpunkt: Informationsmanagement

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<td>3 SWS</td>
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<td>2123357</td>
<td>CAD-NX training course</td>
<td>2 SWS</td>
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<td>Ovtcharova, Mitarbeiter</td>
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<td>CAD-NX Training Course</td>
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<td>CAD-NX Training Course</td>
<td>Prüfung (PR)</td>
<td>Ovtcharova</td>
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**Competence Certificate**
Practical examination on CAD computer, duration: 60 min.

**Prerequisites**
None

**Recommendation**
Dealing with technical drawings is required.

**Annotation**
For the practical course compulsory attendance exists.

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

#### 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
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
### 3.27 Course: CAE-Workshop [T-MACH-105212]

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

#### Part of:
- M-MACH-102582 - Schwerpunkt: Kontinuumsmechanik  
- M-MACH-102583 - Schwerpunkt: Informationsmanagement  
- M-MACH-102746 - Wahlpflichtmodul  
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
- M-MACH-102820 - Schwerpunkt: Mechatronik

### Events

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<td>CAE-Workshop</td>
<td>Block (B)</td>
<td>3 SWS</td>
<td>Albers, Mitarbeiter</td>
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<td>2147175</td>
<td>CAE-Workshop</td>
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### Exams

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<td>CAE-Workshop</td>
<td>Prüfung (PR)</td>
<td>Albers</td>
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</table>

### 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:

### Learning Content

**Content in the summer 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 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 hybrid 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.
CAE-Workshop
2147175, WS 18/19, 3 SWS, Open in study portal

Learning Content
Content in the summer 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 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 hybrid 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.
3.28 Course: CATIA CAD Training Course [T-MACH-102185]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement

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<td>CATIA CAD Training Course</td>
<td>Prüfung (PR)</td>
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</table>

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

Prerequisites
None

Recommendation
Dealing with technical drawings is required.

Annotation
For the practical course attendance is compulsory.

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

CATIA CAD training course
2123358, SS 2018, 3 SWS, Open in study portal

Learning Content
The participant will learn the following knowledge:

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

Annotation
For the practical course attendance is compulsory.

Workload
Regular attendance: 35 hours,
self-study: 12 hours

Literature
practical course skript
Learning Content
The participant will learn the following knowledge:

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

Annotation
For the practical course attendance is compulsory.

Workload
Regular attendance: 35 hours,
self-study: 12 hours

Literature
practical course skript
### 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-102821 - Schwerpunkt: Technische Logistik

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**Competence Certificate**  
oral exam  
30 minutes

**Prerequisites**  
none

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

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

**Cognitive Automobiles - Laboratory**  
2138341, SS 2018, 3 SWS, Open in study portal

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

**Workload**  
120 hours

**Literature**  
TBA
3.0 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-102812 - Schwerpunkt: Antriebssysteme
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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Exams

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</table>

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

Prerequisites
none

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

**Combustion Engines I**
2133113, WS 18/19, 4 SWS, Open in study portal

Learning Content
Introduction, History, Concepts
Working Principle and Thermodynamics
Characteristic Parameters
Air Path
Fuel Path
Energy Conversion
Fuels
Emissions
Exhaust Gas Aftertreatment

Workload
regular attendance: 32 hours
self-study: 88 hours
3.31 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-102638 - Schwerpunkt: Bahnsystemtechnik
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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Events

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<td>Henning</td>
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Competence Certificate
written exam 90 minutes

Prerequisites
none

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

Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies
2114053, SS 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
3.32 Course: Computational Dynamics [T-MACH-105349]

Responsible: Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
M-MACH-104442 - Schwerpunkt: Schwingungslehre

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Competence Certificate

oral exam, 30 min.

Prerequisites

none

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

Computational Dynamics
2162246, SS 2018, 2 SWS, Open in study portal

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!
3.33 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-102582 - Schwerpunkt: Kontinuumsmechanik

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**Exams**

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<td>Computational Homogenization on Digital Image Data</td>
<td>Prüfung (PR)</td>
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</table>

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
nein

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

**Computational homogenization on digital image data**
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 problems

**Workload**
regular attendance: 42 hours (together with tutorial No 2161124)  
self-study: 138 hours

**Literature**
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-102817 - Schwerpunkt: Informationstechnik
M-MACH-102820 - Schwerpunkt: Mechatronik

**Type:**
Prüfungsleistung schriftlich

**Credits:**
4

**Recurrence:**
Each winter term

**Version:**
1

**Events**

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

**Prerequisites**
none

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

**Computational Intelligence**

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**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)


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


Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe; 2008 (PDF frei im Internet)
### 3.35 Course: Computational Vehicle Dynamics [T-MACH-105350]

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

| Part of: | M-MACH-102638 - Schwerpunkt: Bahnsystemtechnik  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik |

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**Exams**

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| 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:

### Computational Vehicle Dynamics

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

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

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102817 - Schwerpunkt: Informationstechnik

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**Events**

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**Competence Certificate**

written exam (Duration: 2 hours)

**Prerequisites**

none

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

**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 exercise course.

**Workload**

regular attendance: 31,5 hours  
self-study: 73,5 hours
Literature
Lecture Notes (Ilias)


3.37 Course: Computer Science for Engineers [T-MACH-105206]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102563 - Informatik

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**Competence Certificate**

Programming assignments, that are to be implemented at the computer, are given every two weeks. The students are supervised by tutors while they work on the assignments. Therefore online tests must be solved by the students to assess the understanding of the tasks and the lecture material. All assignments have to be handed in, before they can take part in the exam.

**Prerequisites**

none

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

**Computer Lab for Computer Science in Mechanical Engineering**

2121392, SS 2018, 2 SWS, Open in study portal

**Learning Content**

Introduction to programming using JAVA

**Workload**

Regular attendance: 21 hours, self-study: 28 hours

**Computer Lab for Computer Science in Mechanical Engineering**

2121392, WS 18/19, 2 SWS, Open in study portal

**Learning Content**

Introduction to programming using JAVA

**Workload**

Regular attendance: 21 hours, self-study: 28 hours
### 3.38 Course: Computer Science for Engineers [T-MACH-105205]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102563 - Informatik

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#### Competence Certificate

Written exam [180 min]

#### Prerequisites

Computer Science for Engineers, passed

#### Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-105206 - Computer Science for Engineers must have been passed.

#### Learning Content

Basis: Information representation- and processing, terms and definitions: alphabet, data, signals, information, numeral systems, propositional logic and Boolean algebra, computer architectures, programming paradigms.  
Object Orientation: Definition and important characteristics of object orientation, Object-oriented modeling with UML.  
Data Structures: Definition, properties and application of graphs, trees, linked lists, queues and stacks.  
Algorithms: Characteristics of algorithms, complexity analysis, design methods, important examples.  
Database management systems: Relational data model, relational algebra, declarative language SQL.

#### Workload

Regular attendance: 21 hours  
Self-study: 134 hours
Learning Content
Basics and language elements of Java
Classes, attributes, methods
Constructors and objects
Loops and conditions
Inheritance, polymorphism
Interfaces, abstract classes
Collections, exceptions
Parallelism, threads

Workload
Regular attendance: 21 hours, self-study: 14 hours

Literature
See lecture
3.39 Course: Computerized Multibody Dynamics [T-MACH-105384]

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

Part of: M-MACH-102582 - Schwerpunkt: Kontinuumsmechanik
M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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Competence Certificate
Oral exam, 30 min.

Prerequisites
none

Recommendation
Knowledge of EM III/IV
### 3.40 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Competence Certificate**

oral examination (about 30 min)

no tools or reference materials

**Prerequisites**

none

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

### Constitution and Properties of Wear resistant materials

2194643, SS 2018, 2 SWS, Open in study portal

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

Copies with figures and tables will be distributed
### 3.41 Course: Control Technology [T-MACH-105185]

**Responsible:** Christoph Gönnheimer  
**Organisation:** KIT Department of Mechanical Engineering  

**Part of:**  
M-MACH-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102817 - Schwerpunkt: Informationstechnik

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**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**Control Technology**

2150683, 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 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
3.42 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-102817 - Schwerpunkt: Informationstechnik
M-MACH-102820 - Schwerpunkt: Mechatronik

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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:

Datenanalyse für Ingenieure

2106014, SS 2018, 3 SWS, Open in study portal

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)
3.43 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-102815 - Schwerpunkt: Entwicklung und Konstruktion

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Competence Certificate

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

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

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

Prerequisites

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

Modal Conditions

The following conditions have to be fulfilled:

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

Recommendation

Knowledge in Fluid Power Systems (LV 2114093)

Annotation

After completion of the lecture, students can:

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

The number of participants is limited.

Content:

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

Literature:

See german recommendations.
Below you will find excerpts from events related to this course:

Design and Development of Mobile Machines
2113079, WS 18/19, 2 SWS, Open in study portal

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 being 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.
### 3.44 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-102815 - Schwerpunkt: Entwicklung und Konstruktion  

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**Competence Certificate**

Preparation of semester report

**Prerequisites**

none
### 3.45 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-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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<td>SWS</td>
<td>Design of a jet engine combustion chamber</td>
<td>Project/Seminar (PJ/S)</td>
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**Competence Certificate**  
The examination is an oral examination on lecture 22527 with a duration of 20 minutes.

**Prerequisites**  
None
3.46 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-102589 - Schwerpunkt: Produktionssysteme

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<td>Design Project Machine Tools and Industrial Handling</td>
<td>Prüfung (PR)</td>
<td>Fleischer</td>
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</table>

**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

The Design Project Machine Tools and 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:**

**Design Project Machine Tools and Industrial Handling**

2149903, WS 18/19, 2 SWS, Open in study portal

**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
**3.47 Course: Design with Plastics [T-MACH-105330]**

**Responsible:** Markus Liedel  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

**Recommendation**

Poly I

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

**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.
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-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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<td>SS 2018 76-T-MACH-105441 Development of Oil-Hydraulic Powertrain Systems</td>
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**Compeence Certificate**

oral exam (20 min)

**Prerequisites**

none

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

**Development of Oil-Hydraulic Powertrain Systems**  
2113072, WS 18/19, 2 SWS, Open in study portal

**Learning Content**

The block 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
Course: Digital Control [T-MACH-105317]

### Responsible
Dr.-Ing. Michael Knoop

### Organisation
KIT Department of Mechanical Engineering

### Part of
M-MACH-102817 - Schwerpunkt: Informationstechnik
M-MACH-102820 - Schwerpunkt: Mechatronik

### Type
Prüfungsleistung schriftlich

### Credits
4

### Recurrence
Each winter term

### Version
1

### Events

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### Exams

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### Competence Certificate
written exam
60 min.

### Prerequisites
none

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

#### Digital Control

2137309, WS 18/19, 2 SWS, Open in study portal

### 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
- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
### 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-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  

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**Competence Certificate**

oral exam (20 min)

**Prerequisites**

none

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

### 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 of synchronesh 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
### 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-102645 - Schwerpunkt: Technik des Verbrennungsmotors

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#### Events

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**Competence Certificate**  
Oral examination, time duration 30 min., no aids

**Prerequisites**  
none

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

#### Drive Systems and Possibilities to Increase Efficiency

2133112, WS 18/19, 1 SWS, [Open in study portal](#)

**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 attendance: 11 h  
self-study: 49 h (grob abschätzen, Richtwert: 2 bis 4 mal Präsenzzeit)

**Literature**

Download of powerpoint slides
3.52 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-102812 - Schwerpunkt: Antriebssysteme

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<td>WS 18/19 2113078 Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'</td>
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**Competence Certificate**
The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in every semester and can be repeated at any regular examination date.

**Prerequisites**
none

**Recommendation**
- General principles of mechanical 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:

**Drive Train of Mobile Machines**
V 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 machineries. The focus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- electrical drives
- hybrid drives
- axles
- terra mechanic

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

Literature
download of scriptum via ILIAS
3.53 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-102812 - Schwerpunkt: Antriebssysteme  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik  
- M-MACH-104442 - Schwerpunkt: Schwingungslehre

**Type**  
Prüfungsleistung mündlich  
**Credits** 5  
**Recurrence** Each winter term  
**Version** 1

### Events

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### Exams

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

**Prerequisites**  
none

**Recommendation**  

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

**Dynamics of the Automotive Drive Train**  
2163111, WS 18/19, 2 SWS, [Open in study portal](#)

**Learning Content**

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

**Workload**

- time of attendance: 39 h  
- self-study: 201 h

**Literature**

- Pfeiffer F., Mechanical System Dynamics, Springer, 2008  
3.54 Course: Electric Rail Vehicles [T-MACH-102121]

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

**Part of:** M-MACH-102638 - Schwerpunkt: Bahnsystemtechnik

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<td>Prüfung (PR)</td>
<td>4</td>
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**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:

**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, dielectic 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).
### Course: Electrical Engineering and Electronics [T-ETIT-109820]

**Responsible:** Dr.-Ing. Klaus-Peter Becker  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-ETIT-104801 - Elektrotechnik

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**Events**

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**Exams**

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**Annotation**

Exam will be held in german language.
3.56 Course: Electrical Engineering and Electronics [T-ETIT-108386]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-104049 - Elektrotechnik

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Events

| WS 18/19 | 2306350 | Electrical Engineering and Electronics for Mechanical Engineers | 4+2 SWS | Lecture / Practice (VÜ) | Stahl, Poletkin |

Exams

| WS 18/19 | 7306350 | Electrical Engineering and Electronics for Mechanical Engineers | Prüfung (PR) | Becker |

Competence Certificate
Written exam, duration 3 hours.

Prerequisites
none

Annotation
Exam will be held in english language.
### 3.57 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-102821 - Schwerpunkt: Technische Logistik

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#### Events

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<td>Elements and Systems of Technical Logistics</td>
<td>Prüfung (PR)</td>
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#### 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:

**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
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-102821 - Schwerpunkt: Technische Logistik

**Type**  
Prüfungsaufgabe anderer Art

**Credits**  
2

**Recurrence**  
Each winter term

**Version**  
1

### Events

<table>
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<th>Events</th>
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<th>Description</th>
<th>Media</th>
<th>Learning Content</th>
</tr>
</thead>
</table>
| WS 18/19 | 2117097 | Elements and systems of Technical Logistics - project | supplementary sheets, presentations, blackboard | - 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. |

### 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:

**Elements and systems of Technical Logistics - project**  
2117097, WS 18/19, SWS, Open in study portal  
Project (PRO)
3.59 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-102812 - Schwerpunkt: Antriebssysteme
M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik
M-MACH-102821 - Schwerpunkt: Technische Logistik

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:

Energy efficient intralogistic systems
2117500, WS 18/19, 2 SWS, Open in study portal

Description
Media:
presentations, black board

Notes
The content of course “Basics of Technical Logistics” should be known.

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.
3.60 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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**Events**

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<tr>
<td>WS 18/19</td>
<td>2189487</td>
<td>Jäger, Stieglitz</td>
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**Exams**

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<td>76-T-MACH-105952</td>
<td>Stieglitz</td>
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**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:

**Energiespeicher und Netzintegration**

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<tr>
<td>WS 18/19</td>
<td>2189487</td>
<td>Jäger, Stieglitz</td>
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</table>

**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.

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

Part of: M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

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Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

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

Energy Systems I - Renewable Energy
2129901, WS 18/19, 3 SWS, Open in study portal

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
### 3.62 Course: Engine Laboratory [T-MACH-105337]

**Responsible:** Dr.-Ing. Uwe Wagner  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102645 - Schwerpunkt: Technik des Verbrennungsmotors

<table>
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<td>Engine Laboratory</td>
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**Exams**

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<td>Engine Laboratory</td>
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</table>

**Competence Certificate**

- written documentation of every experiment, certificate of successful attendance, no grading

**Prerequisites**

- none

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

#### Engine Laboratory

**Type:** Practical course (P)

**Description:**

- Engine Laboratory 2134001, SS 2018, 2 SWS, Open in study portal

**Learning Content**

- 5 engine experiments in up-to-date development projects

**Workload**

- regular attendance: 40 hours
- self-study: 80 hours

**Literature**

- Description of experiments
### Course: Engine Measurement Techniques [T-MACH-105169]

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

**Part of:**  
- M-MACH-102645 - Schwerpunkt: Technik des Verbrennungsmotors  
- M-MACH-102817 - Schwerpunkt: Informationstechnik

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**Competence Certificate**  
oral examination, Duration: 0.5 hours, no auxiliary means

**Prerequisites**  
none

**Recommendation**  
T-MACH-102194 Combustion Engines I

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

**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 aberrations 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
3.64 Course: Engineering Mechanics I [T-MACH-100282]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102572 - Technische Mechanik  
M-MACH-104624 - Orientierungsprüfung

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**Exams**

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<td>Böhlke, Langhoff</td>
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</table>

**Competence Certificate**
written exam, 90 min, graded

**Prerequisites**
successful participation in "Engineering Mechanics I (Tutorial)" (see T-MACH-100528)

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

1. The course T-MACH-100528 - Tutorial Engineering Mechanics I must have been passed.

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

**Engineering Mechanics I**

2161245, WS 18/19, 3 SWS, Open in study portal

**Learning Content**

- basics of vector calculus
- force systems
- statics of rigid bodies
- internal forces and moments in bars and beams
- friction
- centre of gravity, centre of mass
- work, energy, principle of virtual work
- statics of inextensible ropes
- elastostatics of tension-compression- bars

**Workload**

regular attendance: 52.5 hours  
self-study: 127.5 hours
Literature
lecture notes
3.65 Course: Engineering Mechanics II [T-MACH-100283]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102572 - Technische Mechanik  
M-MACH-104624 - Orientierungsprüfung

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<td>SS 2018 3162010</td>
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**Examas**  
SS 2018 76-T-MACH-100283  
WS 18/19 76-T-MACH-100283  
WS 18/19 76-T-MACH-100283-englisch

**Competence Certificate**  
written exam, 90 min, graded

**Prerequisites**  
successful participation in "Engineering Mechanics II (Tutorial)" (see T-MACH-100284)

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

1. The course T-MACH-100284 - Tutorial Engineering Mechanics II must have been passed.

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

**Engineering Mechanics II**  
2162250, SS 2018, 3 SWS, Open in study portal  
Lecture (V)

**Learning Content**

- bending  
- shear  
- torsion  
- stress and strain state in 3D  
- Hooke's law in 3D  
- elasticity theorems in 3D  
- energy methods in elastostatics  
- approximation methods  
- stability  
- inelastic material behaviour

**Workload**  
regular attendance: 42 hours  
self-study: 138 hours
Literature
lecture notes
### 3.66 Course: Engineering Mechanics III & IV [T-MACH-105201]

**Responsible:** Prof. Dr.-Ing. Wolfgang Seemann  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102572 - Technische Mechanik

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**Competence Certificate**  
Written Exam (3 h), graded

**Prerequisites**  
Successful accomplishment of the exercise sheets in Engineering Mechanics III (T-MACH-105202) and of the exercise sheets in Engineering Mechanics IV (T-MACH-105203).

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

1. The course T-MACH-105202 - Tutorial Engineering Mechanics III must have been passed.
2. The course T-MACH-105203 - Tutorial Engineering Mechanics IV must have been passed.

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

**Engineering Mechanics IV**  
2162231, SS 2018, 2 SWS, Open in study portal

**Learning Content**  
Spatial kinematics of a rigid body, Euler angles, angular velocity using Euler angles, Euler's equations, inertia tensor, kinetic energy of a rigid body, free gyroscopes, forced gyroscopes, systems of rigid bodies, principle of d'Alembert, Lagrange's equations of the first and second kind, generalized coordinates, free and forced vibration of one degree of freedom systems, frequency response, vibration of multi degree of freedom systems, vibration absorption

**Workload**  
time of attendance: 24h; self-study: 65h

**Literature**  
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006  
Marguerre: Technische Mechanik III, Heidelberger Taschenbücher, 1968  
Magnus: Kreisel, Theorie und Anwendung, Springer-Verlag, Berlin, 1971  
Klotter: Technische Schwingungslehre, 1. Bd. Teil A, Heidelberg

**Engineering Mechanics III**  
2161203, WS 18/19, 2 SWS, Open in study portal
Learning Content

Kinetics of a particle:
Newton's axiom, Principle of d'Alembert, work of a force, kinetic and potential energies, principle of linear momentum, principle of moment of momentum, kinetics in moving reference systems

Systems of particles:
Principle of center of mass, Principle of moment of momentum, impacts between particles, systems with variable mass, applications.

Plain motion of rigid bodies:

Workload
time of attendance: 24h; self-study: 65h

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006
Gross, Hauger, Schnell: Technische Mechanik Bd. 3, Heidelberg, 1983
Lehmann: Elemente der Mechanik III, Kinetik, Braunschweig, 1975
Göldner, Holzweissig: Leitfaden der Technischen Mechanik.
Hagedorn: Technische Mechanik III.
### 3.67 Course: Exercises in Technical Thermodynamics and Heat Transfer I [T-MACH-105204]

**Responsible:** Prof. Dr. Ulrich Maas  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102574 - Technische Thermodynamik

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

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

Part of: M-MACH-102574 - Technische Thermodynamik

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</table>

Competence Certificate

Homework is mandatory.

Prerequisites

none

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

Technical Thermodynamics and Heat Transfer II (Tutorial)

2166556, SS 2018, 2 SWS, [Open in study portal]

Learning Content

Calculation of thermodynamical problems

Workload

Regular attendance: 21,0 hours
Self-study: 28 hours

Literature

Course notes
# 3.69 Course: Exercices - Tribology [T-MACH-109303]

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

**Part of:** M-MACH-102812 - Schwerpunkt: Antriebssysteme

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**Competence Certificate**

successful solving of all exercises

**Prerequisites**

none

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

## 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, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- **Chapter 2: Wear**
  - plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running-in dynamics, shear stress.
- **Chapter 3: Lubrication**
  - base oils, Striebeck 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

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

Responsible: Dr.-Ing. Jens Gibmeier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Competence Certificate**
Regular attendance

**Prerequisites**
none
### 3.71 Course: Experimental Dynamics [T-MACH-105514]

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

**Part of:**  
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik  
- M-MACH-104442 - Schwerpunkt: Schwingungslehre

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#### Competence Certificate

oral exam, 30 min.

#### Prerequisites

Can not be combined with Practical Training in Measurement of Vibrations (T-MACH-105373).

#### Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-105373 - Practical Training in Measurement of Vibrations must not have been started.

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

### Experimental Dynamics

2162225, SS 2018, 3 SWS, Open in study portal  

**Lecture (V)**

#### Learning Content

1. Introduction  
2. Measurement principles  
3. Sensors as coupled multi-physical systems  
4. Digital signal processing, measurements in frequency domain  
5. Forced non-linear vibrations  
6. Stability problems (Mathieu oscillator, friction induces vibrations)  
7. Elementary rotor dynamics  
8. Modal analysis

**Annotation**

The lectures will be accompanied by the laboratory experiments

**Workload**

- time of attendance: 29 h  
- self-study: 121 h
3.72 Course: Experimental Fluid Mechanics [T-MACH-105512]

Responsible: Dr. Jochen Kriegseis
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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Competence Certificate
oral exam - 30 minutes

Prerequisites
none

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

Experimental Fluid Mechanics

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
3.73 Course: Failure Analysis [T-MACH-105724]

Responsible: Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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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:

Failure Analysis
2182572, WS 18/19, 2 SWS, Open in study portal

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
3.74 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-102582 - Schwerpunkt: Kontinuumsmechanik  
M-MACH-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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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 knowledge in mathematics, mechanics and materials science

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

Failure of structural materials: deformation and fracture
2181711, WS 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 elastic fracture mechanics
   ◦ crack resistance
   ◦ 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
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relatively simple but yet comprehensive overview of metallic materials
### 3.75 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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

**Prerequisites**  
none

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

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

### 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 Description of Creep  
2.4 Creep Mechanisms  
2.5 Alloying Effects

**Workload**  
regular attendance: 22.5 hours  
self-study: 97.5 hours
Literature

- 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
3.76 Course: Fatigue of Metallic Materials [T-MACH-105354]

**Responsible:** Dr. Karl-Heinz Lang  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Events**

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<td>2173585</td>
<td>Fatigue of Metallic Materials</td>
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**Exams**

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<td>76-T-MACH-105354</td>
<td>Fatigue of Metallic Materials</td>
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**Competence Certificate**  
Oral exam, about 20 minutes

**Prerequisites**  
none

**Recommendation**  
Basic knowledge in Materials Science will be helpful.

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

**Fatigue of Metallic Materials**  
2173585, WS 18/19, 2 SWS, Open in study portal

**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.
3 COURSES

Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

3.77 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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<td>Practice (Ü)</td>
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Exams

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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

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

- Mueller, U., Zweiphasenströmung, Vorlesungsmanuskript, Februar 2000, 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
**3.78 Course: Fluid Mechanics 1&2 [T-MACH-105207]**

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102565 - Strömungslehre

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**Events**

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<td>Lecture / Practice (VÜ)</td>
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**Exams**

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**Competence Certificate**

written exam 3 hours

**Prerequisites**

none

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

**Fluid Mechanics I**

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<td>Fluid Mechanics I</td>
<td>Lecture / Practice (VÜ)</td>
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**Description**

**Media:** Blackboard, Power Point, Experiments

**Learning Content**

properties of fluids, surface tension, hydro- and aerostatics, kinematics, stream tube theory (compressible and incompressible), losses in pipeline systems, dimensional analysis, dimensionless numbers

**Workload**

regular attendance: 32 hours  
self-study: 88 hours

**Literature**

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library

**Fluid Mechanics I**

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</table>
Description
Media:
Blackboard, Power Point, Experiments

Learning Content
properties of fluids, surface tension, hydro- and aerostatics, kinematics, stream tube theory (compressible and incompressible), losses in pipeline systems, dimensional analysis, dimensionless numbers

Workload
regular attendance: 32 hours
self-study: 88 hours

Literature
Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library

Fluid Mechanics II
2153512, WS 18/19, 3 SWS, Open in study portal

Description
Media:
Blackboard, Power Point, Experiments

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

Workload
regular attendance: 32 hours
self-study: 88 hours

Literature
Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library

Fluid Mechanics II
3153511, WS 18/19, 3 SWS, Open in study portal
3.79 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-102746 - Wahlpflichtmodul
- M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Competence Certificate**
The assessment consists of a written exam (90 minutes) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**
none

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

**Fluid Technology**
2114093, WS 18/19, 2 SWS, [Open in study portal](#)

**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
3.80 Course: Foundry Technology [T-MACH-105157]

Responsible: Dr.-Ing. Christian Wilhelm
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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Exams

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Competence Certificate
oral exam; about 25 minutes

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

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

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
3.81 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-102645 - Schwerpunkt: Technik des Verbrennungsmotors
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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

Prerequisites
none

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

**Fuels and Lubricants for Combustion Engines**

2133108, WS 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
3.82 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-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Events**

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**Competence Certificate**

Oral group examination

**Duration:** 30 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

Fundamentals for Design of Motor-Vehicles Bodies I  
2113814, WS 18/19, 1 SWS, [Open in study portal](#)

**Learning Content**

1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technology

6. Body in white / body production, body surface

**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
3.83 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-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

### Events

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| WS 18/19        | Prüfung | Each summer term            | 1       |
| 76-T-MACH-102119 | 2       |                            |         |
| Fundamentals for Design of Motor-Vehicles Bodies II | 1 SWS | Lecture (V) | 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:**

**Fundamentals for Design of Motor-Vehicles Bodies II**

Lecture (V)

2114840, SS 2018, 1 SWS, Open in study portal

### 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
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-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

### Events

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**Exams**

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### Competence Certificate

**Oral group examination**

**Duration:** 30 minutes

**Auxiliary means:** none

### Prerequisites

none

---

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

**Fundamentals in the Development of Commercial Vehicles I**

Lecture (V)

2113812, WS 18/19, 1 SWS, [Open in study portal](#)

### Learning Content

1. Introduction, definitions, history
2. Development tools
3. Complete vehicle
4. Cab, bodystyle 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

3.85 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-102815 - Schwerpunkt: Entwicklung und Konstruktion  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**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:*

**Fundamentals in the Development of Commercial Vehicles II**  
2114844, SS 2018, 1 SWS, [Open in study portal](#)

**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


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

**Responsible:** Dipl.-Ing. Rolf Frech  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**  
Written examination  
Duration: 90 minutes  
Auxiliary means: none

**Prerequisites**  
none

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

**Fundamentals of Automobile Development I**  
2113810, WS 18/19, 1 SWS, Open in study portal

**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

**Principles of Whole Vehicle Engineering I**  
2113851, WS 18/19, 1 SWS, Open in study portal
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
3 COURSES
Course: Fundamentals of Automobile Development II [T-MACH-105163]

T 3.87 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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Competence Certificate
Written examination
Duration: 90 minutes
Auxiliary means: none

Prerequisites
none

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

V  Fundamentals of Automobile Development II
2114842, SS 2018, 1 SWS, Open in study portal

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.
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-102645 - Schwerpunkt: Technik des Verbrennungsmotors  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

**Type**  
Prüfungsleistung mündlich

**Credits**  
4

**Recurrence**  
Each summer term

**Version**  
1

**Events**

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

**Prerequisites**  
none

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

**Fundamentals of catalytic exhaust gas aftertreatment**  
2134138, SS 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

3.89 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-102645 - Schwerpunkt: Technik des Verbrennungsmotors
M-MACH-102746 - Wahlpflichtmodul

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Exams

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Competence Certificate
oral exam, 30 min

Prerequisites
none

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

**Fundamentals of Combustion Engine Technology**
2133123, WS 18/19, 2 SWS, Open in study portal

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
### 3.90 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-102746 - Wahlpflichtmodul  
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Competence Certificate**  
Written exam, 3 h

**Prerequisites**  
none

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

### Fundamentals of Combustion I  
2165515, WS 18/19, 2 SWS, Open in study portal

**Description**  
Lecture (V)

**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,

Fundamentals of Combustion I (Tutorial)
2165517, WS 18/19, 1 SWS, Open in study portal

Practice (Ü)

Literature

• Lecture Notes
3.91 Course: Fundamentals of Combustion II [T-MACH-105325]

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

Part of: M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik
       M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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Competence Certificate
oral exam, 20 min

Prerequisites
none

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

Fundamentals of combustion II
2100002, SS 2018, 2 SWS, Open in study portal

Description
Media:
Blackboard and Powerpoint presentation

Learning Content
- Three dimensional Navier-Stokes equations for reacting flows
- Turbulent 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;
Fundamentals of combustion II
2166538, SS 2018, 2 SWS, Open in study portal

Description
Media:
Blackboard and Powerpoint presentation

Learning Content
- Three dimensional Navier-Stokes equations for reacting flows
- Turbulent 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;

Übung zu Grundlagen der technischen Verbrennung II
2166539, SS 2018, 1 SWS, Open in study portal

Learning Content
Calculation and Simulation of combustion processes

Workload
regular attendance: 21 hours

Literature
Lecture notes
3.92 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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<td>Prüfung (PR)</td>
<td>Badea, Cheng</td>
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**Competence Certificate**

Written examination, 90 min

**Prerequisites**

none

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

**Fundamentals of Energy Technology**

2130927, SS 2018, 3 SWS, [Open in study portal]

**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 storage
- Transport of energy
- Power generation and environment. Future of the energy industry

**Workload**

lectures: 45 h
preparation to exam: 195 h
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
3.93 Course: Gasdynamics [T-MACH-105533]

**Responsible:** Dr.-Ing. Franco Magagnato

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik
- M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**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:*

**Gasdynamics**

2154200, SS 2018, 2 SWS, [Open in study portal]

**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**


3.94 Course: Gear Cutting Technology [T-MACH-102148]

**Responsible:** Dr. Markus Klaiber  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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<td>2149655</td>
<td>Gear Cutting Technology</td>
<td>2 SWS</td>
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**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:*

**Gear Cutting Technology**  
2149655, WS 18/19, 2 SWS, [Open in study portal](#)

**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
3.95 Course: Global Logistics [T-MACH-105379]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102644 - Schwerpunkt: Production Engineering

### Type

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### Events

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### Exams

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**Competence Certificate**

oral exam (20 min)

**Prerequisites**

none

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

**Global Logistics**

3118095, SS 2018, 2 SWS, Open in study portal

**Block lecture (BV)**

**Notes**

The course takes place in form of a block event, i.e. all lectures will be given in one week. The dates of the lecture, i.e. the respective week, will be published on the IFL homepage.
Learning Content

Conveyor Systems
- Basic elements of conveyor systems
- Key figures
- Branching elements
- continuous/partially-continuous
- deterministic/stochastic switch
- Integration elements
- continuous/partially-continuous
- dispatching rules

Queueing Theory and Production Logistics
- Basic queueing systems
- Distributions
- M|M|1 and M|G|1 model
- Application on production logistics

Distribution Centers and Order Picking
- The location problem
- Distribution centers
- Inventory management
- Order picking

Vehicle Routing
- Types of vehicle routing problems
- Linear programming model and graph theoretic model
- Heuristics
- Supporting technologies

Optimization of Logistical Networks
- Objectives
- Cooperative strategies
- Supply chain management
- Implementation

Annotation
Attendance during lecture is required

Literature
Arnold, Dieter; Furmans, Kai: Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg,
### 3.96 Course: Global Production Engineering (MEI) [T-MACH-106731]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102644 - Schwerpunkt: Production Engineering

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**Exams**

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**Competence Certificate**

oral exam (45 min group examination with 3 students)

**Prerequisites**

none

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

#### Global Production Engineering (MEI)

3150040, SS 2018, 2 SWS, Open in study portal  
Lecture (V)

**Learning Content**

Target of the lecture is to depict the challenges of global operating companies and to give an overview of central aspects and methods in production planning. The lecture will regard site-related production factors and give the basic steps in site-selection, before the planning of manufacturing systems is focused. Herein, not only the planning phases are regarded, but also the methods used.

- The topics are:
  - Challenges of global production
  - Establishing of new production sites
  - The basic steps in manufacturing system planning
  - Steps and methods of factory planning
  - Manufacturing and assembly planning. Assembly panning will be focused.
  - Layout and material flow of production sites
  - Production planning and control basics
3.97 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**  
Verbally  
Duration: 30 up to 40 minutes  
Auxiliary means: none

**Prerequisites**  
none

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

**Handling Characteristics of Motor Vehicles I**  
2113807, WS 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**
3.98 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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Competence Certificate

Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites

none

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

Handling Characteristics of Motor Vehicles II
2114838, SS 2018, 2 SWS, Open in study portal

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

3.99 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-102746 - Wahlpflichtmodul

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**Competence Certificate**
Written exam, 3 h

**Prerequisites**
none

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

### Heat and mass transfer
2165512, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**

**Learning Content**

- Steady state and non-steady heat transfer in homogenous and compound materials; Plates, pipe sections and spirical shells
- Molecular, equimolecular and unilateral diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transmission in passed through pipes/channels and circulated around plate and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transmission (condensation, 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"
### 3.100 Course: Human Factors Engineering I [T-MACH-105518]

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

**Part of:** M-MACH-102589 - Schwerpunkt: Produktionssysteme

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#### Events

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</table>

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

**Prerequisites**  
none

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

### Human Factors Engineering I: Ergonomics

2109035, WS 18/19, 2 SWS, [Open in study portal](#)

**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 advocacy groups

**Workload**

The amount of work accounts for 120 h (=4 ECTS).

**Literature**

The lecture material is available on ILIAS for download.
3 COURSES
Course: Human Factors Engineering II [T-MACH-105519]

3.101 Course: Human Factors Engineering II [T-MACH-105519]

- **Responsible:** Prof. Dr.-Ing. Barbara Deml
- **Organisation:** KIT Department of Mechanical Engineering
- **Part of:** M-MACH-102589 - Schwerpunkt: Produktionssysteme

**Events**

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**Prerequisites**

None

**Competence Certificate**

written exam, 60 minutes

The exams are only offered in German!

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

**Human Factors Engineering II: Work Organisation**

- **Code:** 2109036, WS 18/19, 2 SWS, [Open in study portal](#)

**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.
### 3.102 Course: Human-Machine-Interaction [T-INFO-101266]

**Responsible:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-102820 - Schwerpunkt: Mechatronik

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**Modeled Conditions**  
The following conditions have to be fulfilled:  
1. The course T-INFO-106257 - Human-Machine-Interaction must have been passed.
3.103 Course: Human-Machine-Interaction [T-INFO-106257]

**Responsible:** Prof. Dr.-Ing. Michael Beigl

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-102820 - Schwerpunkt: Mechatronik

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### 3.104 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-102812 - Schwerpunkt: Antriebssysteme  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
- M-MACH-102820 - Schwerpunkt: Mechatronik

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**Prerequisites**  
none
3.105 Course: Hydraulic Fluid Machinery [T-MACH-105326]

**Responsible:** Dr. Balazs Pritz  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik  
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Exams**

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**Competence Certificate**
oral exam, 40 min.

**Prerequisites**
None.

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

### Lecture (V)  
**Hydraulic Fluid Machinery**  
2157432, SS 2018, 4 SWS, [Open in study portal](#)

**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  
5. Carolus, T.: Ventilatoren, Teubner-Verlag  
6. Kreiselpumpenlexikon, KSB Aktiengesellschaft  
7. Zierep, J., Bühler, K.: Grundzüge der Strömungslehre, Teubner-Verlag
**Course: I4.0 Systems platform [T-MACH-106457]**

**Responsible:** Dipl.-Ing. Thomas Maier  
Prof. Dr.-Ing. Jivka Ovtcharova

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102583 - Schwerpunkt: Informationsmanagement

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**Competence Certificate**  
Alternative exam assessment (project work)

**Prerequisites**  
None

**Annotation**  
Limited number of participants.

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

**I4.0 Systems platform**  
2123900, SS 2018, 4 SWS, Open in study portal

**Notes**  
Number of participants limited to 20 people. There is a participant selection process.

**Learning Content**  
Industry 4.0, IT systems for fabrication (e.g.: CAx, PDM, CAM, ERP, MES), process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.
### 3.107 Course: Ignition systems [T-MACH-105985]

**Responsible:** Dr.-Ing. Olaf Toedter  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102645 - Schwerpunkt: Technik des Verbrennungsmotors

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**Competence Certificate**  
oral exam, 20 min

**Prerequisites**  
none
3.108 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**  
oral exam - 30 minutes

**Prerequisites**  
none

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

**Industrial aerodynamics**  
2153425, WS 18/19, 2 SWS, Open in study portal

**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 exemplary. 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 combustion at direct injected Diesel engines  
- Flow mixing and combustion 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
3.109 Course: Information Engineering [T-MACH-102209]

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

Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement

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Competence Certificate
Alternative exam assessment (written composition and speech)

Prerequisites
None
3.110 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-102817 - Schwerpunkt: Informationstechnik

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Competence Certificate

Written exam (Duration: 1 h)

Prerequisites

none

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

Information Processing in Mechatronic Systems

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

3.111 Course: Information Processing in Sensor Networks [T-INFO-101466]

**Responsible:** Prof. Dr.-Ing. Uwe Hanebeck

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-102817 - Schwerpunkt: Informationstechnik

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3.112 Course: Information Systems and Supply Chain Management [T-MACH-102128]

Responsible: Dr. Christoph Kilger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement
M-MACH-102817 - Schwerpunkt: Informationstechnik

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

Prerequisites
none

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

V Information Systems in Logistics and Supply Chain Management
2118094, SS 2018, 2 SWS, Open in study portal

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
3 COURSES

Course: Integrated Information Systems for Engineers [T-MACH-102083]

3.113 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-102583 - Schwerpunkt: Informationsmanagement
         M-MACH-102589 - Schwerpunkt: Produktionssysteme
         M-MACH-102746 - Wahlpflichtmodul

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Competence Certificate

Oral examination 20 min.

Prerequisites

None

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

Integrated Information Systems for engineers
2121001, SS 2018, 3 SWS, Open in study portal

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
3.114 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-102589 - Schwerpunkt: Produktionssysteme

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Competence Certificate
Oral Exam (40 min)

Prerequisites
"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

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

Integrated Production Planning in the Age of Industry 4.0
2150660, SS 2018, 6 SWS, Open in study portal

Description
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
3 COURSES

Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

3.115 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-102815 - Schwerpunkt: Entwicklung und Konstruktion

M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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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:

Integrative Strategies in Production and Development of High Performance Cars

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
### 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-102583 - Schwerpunkt: Informationsmanagement  
- M-MACH-102812 - Schwerpunkt: Antriebssysteme  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
- M-MACH-102820 - Schwerpunkt: Mechatronik

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

**Prerequisites**  
none

**Recommendation**  
None

---

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

#### Intellectual Property Rights and Strategies in Industrial Companies  
2147161, WS 18/19, 2 SWS, Open in study portal

**Lecture (V)**
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
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

**Type:** Prüfungsleistung schriftlich  
**Credits:** 6  
**Recurrence:** Each winter term  
**Version:** 2

**Events**

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**Exams**

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**Competence Certificate**

Oral exam (Duration: 2h)

**Prerequisites**

none

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

**Introduction into Mechatronics**

**Code:** 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**

3.118 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-102746 - Wahlpflichtmodul
- M-MACH-102812 - Schwerpunkt: Antriebssysteme
- M-MACH-102820 - Schwerpunkt: Mechatronik
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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Events

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Exams

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Competence Certificate
Written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

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

Introduction into the multi-body dynamics
2162235, SS 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 virtual 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
de Jalón, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody System.
Kane, T.: Dynamics of rigid bodies.
3.119 Course: Introduction to Ceramics [T-MACH-100287]

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

Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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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:

Introduction to Ceramics
2125757, WS 18/19, 3 SWS, Open in study portal

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 significantly 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

- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier
3.120 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-104442 - Schwerpunkt: Schwingungslehre

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<td>2162247 Introduction to Nonlinear Vibrations</td>
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**Competence Certificate**
oral exam, 30 min.

**Prerequisites**
none

**Recommendation**
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

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

**Introduction to Nonlinear Vibrations**
2162247, WS 18/19, 2 SWS, Open in study portal

**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


Introduction into the nonlinear vibrations (Tutorial)
2162248, WS 18/19, 2 SWS. Open in study portal

Workload

- time of attendance: 10.5h; self-study: 20h
3.121 Course: Introduction to Nuclear Energy [T-MACH-105525]

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

**Organisation:** KIT Department of Mechanical Engineering

**Organisation:**

**Part of:** M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

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**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
### 3.122 Course: Introduction to Numerical Fluid Dynamics [T-MACH-105515]

**Responsible:** Dr. Balazs Pritz  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Competence Certificate**
Certificate of participation

**Prerequisites**
none

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

### 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
3.123 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-102582 - Schwerpunkt: Kontinuumsmechanik

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**Competence Certificate**

written exam (90 min). Additives 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:

**Introduction to the Finite Element Method**

2162282, SS 2018, 2 SWS, Open in study portal

**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)
3.124 Course: IT-Fundamentals of Logistics [T-MACH-105187]

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

Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement
          M-MACH-102812 - Schwerpunkt: Antriebssysteme
          M-MACH-102817 - Schwerpunkt: Informationstechnik
          M-MACH-102820 - Schwerpunkt: Mechatronik

**Type**
Prüfungsleistung mündlich

**Credits**
4

**Recurrence**
Each summer term

**Version**
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**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
3.125 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-102817 - Schwerpunkt: Informationstechnik

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Competence Certificate

Colloquia

Prerequisites

none

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

Lab Computer-aided methods for measurement and control
2137306, WS 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.
3.126 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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Competence Certificate
1 report, approx. 12 pages
Discussion of the documented results with the assistants

Prerequisites
none

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

Laboratory Exercise in Energy Technology
2171487, SS 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 period at: http://www.its.kit.edu
Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

**Workload**
- regular attendance: 42h
- self-study: 78h

**Laboratory Exercise in Energy Technology**
2171487, WS 18/19, 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
- Heat pump
- Plant oil stove
- Heat capacity
- Wood combustion

**Annotation**
Online registration within the first two weeks of the lecture period at: [http://www.its.kit.edu](http://www.its.kit.edu)

**Workload**
- regular attendance: 42h
- self-study: 78h
3.127 Course: Laboratory Laser Materials Processing [T-MACH-102154]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**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:

**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

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
3.128 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-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102817 - Schwerpunkt: Informationstechnik  
M-MACH-102820 - Schwerpunkt: Mechatronik

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**Competence Certificate**

certificate of successful attendance

**Prerequisites**

None

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

**Laboratory mechatronics**

2105014, WS 18/19, 3 SWS, Open in study portal

**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
3.129 Course: Laboratory Production Metrology [T-MACH-108878]

Responsible: Dr.-Ing. Benjamin Häfner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102589 - Schwerpunkt: Produktionssysteme
         M-MACH-102820 - Schwerpunkt: Mechatronik

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Competence Certificate
Alternative test achievement:
Group presentation

Prerequisites
none

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

Laboratory Production Metrology
2150550, SS 2018, 3 SWS, Open in study portal

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
- Coordinate 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
3.130 Course: Laser in Automotive Engineering [T-MACH-105164]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.

Recommendation
preliminary knowlegde in mathematics, physics and materials science

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

V Laser in automotive engineering
2182642, SS 2018, 2 SWS, Open in study portal

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**
3.131 Course: Leadership and Conflict Management [T-MACH-105440]

Responsible: Hans Hatzl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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

**Prerequisites**
none

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

**Leadership and Conflict Management (in German)**

2110017, SS 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.
### 3.132 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-102812 - Schwerpunkt: Antriebssysteme
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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**Competence Certificate**

oral exam (20 min)

**Prerequisites**

none

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

### Leadership and Product Development

**2145184, WS 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
3.133 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-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**

Written examination (60 min)

**Prerequisites**

None

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

**Lightweight Engineering Design**

**Description**

**Media:**

Beamer

**Learning Content**

General aspects of lightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling

Additionally, guest speakers from industry will present lightweight design from 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
### 3.134 Course: Machine Dynamics [T-MACH-105210]

**Responsible:** Prof. Dr.-Ing. Carsten Proppe  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:**  
- M-MACH-102746 - Wahlpflichtmodul  
- M-MACH-102812 - Schwerpunkt: Antriebssysteme  
- M-MACH-102820 - Schwerpunkt: Mechatronik  
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik  
- M-MACH-104442 - Schwerpunkt: Schwingungslehre

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#### Events

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#### Exams

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#### Competence Certificate

written exam, 180 min.

#### Prerequisites

none

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

### 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 exercises: 32 h  
Studies: 118 h

**Literature**

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979  
Dresig, Vulfson: Dynamik der Mechanismen, 1989

### Machine Dynamics (Tutorial)

2161225, SS 2018, 1 SWS, [Open in study portal](#)

**Practice (Ü)**

**Learning Content**

Exercises related to the lecture
3.135 Course: Machine Dynamics II [T-MACH-105224]

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

**Part of:**  
M-MACH-102812 - Schwerpunkt: Antriebssysteme  
M-MACH-102820 - Schwerpunkt: Mechatronik  
M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik  
M-MACH-104442 - Schwerpunkt: Schwingungslehre

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

**Prerequisites**  
none

**Recommendation**  
Machine Dynamics

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

**Machine Dynamics II**

2162220, WS 18/19, 2 SWS, [Open in study portal](#)

**Learning Content**

- hydrodynamic bearings
- rotating shafts in hydrodynamic bearings
- belt drives
- vibration of turbine blades

**Workload**

Lectures: 20 h  
Self-studies: 100 h

**Literature**

### 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-102589 - Schwerpunkt: Produktionssysteme  
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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**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:**

**Machine Tools and Industrial Handling**

2149902, WS 18/19, 6 SWS, [Open in study portal](https://ilias.studium.kit.edu/)

**Description**

**Media:**

Lecture notes will be provided in Ilias

**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
Wiling/TVWL
regular attendance: 63 hours
self-study: 207 hours
3.137 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-102817 - Schwerpunkt: Informationstechnik

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**Exams**

| SS 2018         | Machine Vision | Prüfung (PR) | Stiller, Lauer |
| WS 18/19        | 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:
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 discussion 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 valuable 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 developed 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 techniques 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.
**3.138 Course: Machines and Processes [T-MACH-105208]**

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Dr.-Ing. Heiko Kubach  
Prof. Dr. Ulrich Maas  
Dr. Balazs Pritz  

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102566 - Maschinen und Prozesse

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**Competence Certificate**
written exam (duration: 120 min)

**Prerequisites**
Taking part at the exam is possible only when lab course has been successfully completed

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

1. The course **T-MACH-105232 - Machines and Processes, Prerequisite** must have been passed.

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

**Machines and Processes**

2185000, WS 18/19, 4 SWS, [Open in study portal](#)

**Description**

**Media:**
slides to download  
Documentartion of the labcourse
Learning Content
basics of thermodynamics
thermal fluid machines
  • steam turbines
  • gas turbines
  • combined-cycle plants
  • turbines and compressors
  • aircraft engines
hydraulic fluid machines
  • operating performance
  • characterization
  • control
  • cavitation
  • wind turbines, propellers
internal combustion engines
  • characteristic parameters
  • engine parts
  • kinematics
  • engine processes
  • emissions

Annotation
Lab course and lecture take place in summer and winter semester.
In the SS the lecture is held in English. The lab course is always bilingual.

Workload
regular attendance: 48 h, self-study: 160 h
3.139 Course: Machines and Processes, Prerequisite [T-MACH-105232]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Dr.-Ing. Heiko Kubach  
Prof. Dr. Ulrich Maas  
Dr. Balázs Pritz

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102566 - Maschinen und Prozesse

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**Competence Certificate**

successful completed training course

**Prerequisites**

none

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

**Machinery and Processes**

2187000, SS 2018, 1 SWS, [Open in study portal](#)

**Practical course (P)**

**Description**

**Media:**

slides to download

Documentation of the labcourse
Learning Content
basics of thermodynamics
thermal fluid machines
  • steam turbines
  • gas turbines
  • combined-cycle plants
  • turbines and compressors
  • aircraft engines
hydraulic fluid machines
  • operating performance
  • characterization
  • control
  • cavitation
  • wind turbines, propellers
internal combustion engines
  • characteristic parameters
  • engine parts
  • kinematics
  • engine processes
  • emissions

Annotation
Lab course and lecture take place in summer and winter semester.
In the SS the lecture is held in English. The lab course is always bilingual.

Workload
regular attendance: 48 h, self-study: 160 h

Machinery and Processes
2187000, WS 18/19, 1 SWS, Open in study portal

Description
Media:
slides to download
Documentation of the lab course

Learning Content
basics of thermodynamics
thermal fluid machines
  • steam turbines
  • gas turbines
  • combined-cycle plants
  • turbines and compressors
  • aircraft engines
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  • operating performance
  • characterization
  • control
  • cavitation
  • wind turbines, propellers
internal combustion engines
  • characteristic parameters
  • engine parts
  • kinematics
  • engine processes
  • emissions
**Annotation**
Lab course and lecture take place in summer and winter semester.
In the SS the lecture is held in English. The lab course is always bilingual.

**Workload**
regular attendance: 48 h, self-study: 160 h
### T 3.140 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-102589 - Schwerpunkt: Produktionssysteme  
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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

**Prerequisites**  
None

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

### Manufacturing Technology  
2149657, WS 18/19, 6 SWS, [Open in study portal](#)

**Description**  
Lecture notes will be provided in ilias ([https://ilias.studium.kit.edu/](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 (maching with geometrically defined and geometrically undefined cutting edges, separating, abrading)  
- Joining  
- Coating  
- Heat treatment and surface treatment  
- Process chains in manufacturing

This lecture provides an excursion to an industry company.
Annotation
None

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

Literature
Lecture Notes
3.141 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-102589 - Schwerpunkt: Produktionssysteme
M-MACH-102821 - Schwerpunkt: Technische Logistik

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<td>Each winter term</td>
<td>Prüfung (PR)</td>
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<td>2117051</td>
<td>Material flow in logistic systems</td>
<td>Others (sonst.)</td>
<td>Furmans</td>
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<th>Recurrence</th>
<th>Type</th>
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<tr>
<td>SS 2018</td>
<td>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.</td>
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<td>76-T-MACH-102151</td>
<td>Material Flow in Logistic Systems</td>
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<td>Material Flow in Logistic Systems</td>
<td>Prüfung (PR)</td>
<td>Furmans</td>
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</table>

**Competence Certificate**

The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade):
  - 40% assessment of the result of the case studies as group work,
  - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

**Prerequisites**

none

**Recommendation**

Recommended elective subject: Probability Theory and Statistics

**Annotation**

Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

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

**Material flow in logistic systems**

2117051, WS 18/19, 4 SWS, Open in study portal

**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
3.142 Course: Materials and Processes for Body Lightweight 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Events**

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<td>Materials and Processes for Body Lightweight Construction in the Automotive Industry</td>
<td>2 SWS</td>
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</table>

**Competence Certificate**

**Prerequisites**

none

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

**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
### 3.143 Course: Materials Characterization [T-MACH-107684]

**Responsible:** Dr.-Ing. Jens Gibmeier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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#### Events

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<td>Werkstoffanalytik</td>
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<td>Materials Characterization</td>
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<td>Heilmaier, Gibmeier</td>
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</table>

#### 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.
3.144 Course: Materials of Lightweight Construction [T-MACH-105211]

Responsible: Prof. Dr.-Ing. Kay Weidenmann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

### Type
Prüfung (PR)

### Credits
4

### Recurrence
Each summer term

### Version
1

**Events**

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**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:

**Materials for Lightweight Construction**

| 2174574, SS 2018, 2 SWS, Open in study portal | Lecture (V) |
Learning Content
Introduction
Constructive, production-oriented and material aspects of lightweight construction
Aluminium-based alloys
Aluminium wrought alloys
Aluminium cast alloys
Magnesium-based alloys
Magnesium wrought alloys
Magnesium cast alloys
Titanium-based alloys
Titanium wrought alloys
Titanium cast alloys
High-strength steels
High-strength structural steels,
Heat-treatable steels, press-hardening and hardenable steels
Composites - mainly PMC
Matrices
Reinforcements
Basic mechanical principles of composites
Hybrid composites
Special materials for lightweight design
Beryllium alloys
Metallic Glasses
Applications

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
### 3.145 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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<td>Übungen zu Werkstoffkunde III</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
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<td>Materials Science III</td>
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<td>Prüfung (PR)</td>
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**Competence Certificate**  
Oral exam, about 35 minutes

**Prerequisites**  
none

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

### Materials Science and Engineering III  
2173553, WS 18/19, 4 SWS, [Open in study portal]

**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  
3.146 Course: Materials Science I & II [T-MACH-105145]

**Responsible:** Dr.-Ing. Jens Gibmeier
Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Kay Weidenmann

**Organisation:** KIT Department of Mechanical Engineering

**Type**
- Prüfungsleistung mündlich

**Credits**
- 11

**Recurrence**
- Each winter term

**Version**
- 2

### Events

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<td>Materials Science and Engineering II for mach, phys</td>
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<td>Heilmaier, Ulrich</td>
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<td>SS 2018</td>
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<td>Materials Science and Engineering II (Lecture)</td>
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<td>WS 18/19</td>
<td>2173550</td>
<td>Materials Science and Engineering I for mach, phys</td>
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<td>Seifert, Ulrich, Pundt, Heilmaier</td>
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<td>Materials Science and Engineering I (Tutorial)</td>
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### Exams

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<td>Heilmaier</td>
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**Competence Certificate**
- oral exam, about 25 minutes

**Prerequisites**
- Lab course must be finished successfully prior to the registration for the oral exam.

**Modeled Conditions**
- The following conditions have to be fulfilled:
  1. The course T-MACH-105146 - Materials Science Lab Course must have been passed.

**Annotation**
- The workload for the lecture Materials Science I & II is 165 h per semester and consists of the presence during the lectures (WS: 4 SWS, SS: 2SWS) and the exercises (1 SWS per WS and 1 SWS per SS) as well as preparation and rework time at home.

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

**Materials Science and Engineering II for mach, phys**

2174560, SS 2018, 3 SWS, Open in study portal

Lecture (V)
Learning Content
Ferrous materials
Non-ferrous metals and alloys
Engineering ceramics
Glasses
Polymers
Composites

Workload
regular attendance: 42 hours
self-study: 108 hours

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005

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Learning Content
Atomic structure and atomic bonds
Structures of crystalline solids
Defects in crystalline solids
Structure of amorphous and semi-crystalline solids
Alloys
Transport and transformation phenomena in the solid state
Microscopy methods
Characterization by means of X-rays, Neutrons and Electrons
Nondestructive testing of materials
Mechanical testing of materials

Workload
regular attendance: 53 hours
self-study: 157 hours

Literature
Lecture Notes; Problem Sheets;

Shackelford, J.F.
Werkstofftechnologie für Ingenieure
Verlag Pearson Studium, 2005
3.147 Course: Materials Science Lab Course [T-MACH-105146]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
Prof. Dr. Anton Möslang  
Prof. Dr.-Ing. Kay Weidenmann  

**Organisation:** KIT Department of Mechanical Engineering

**Type** Studienleistung praktisch  
**Credits** 3  
**Recurrence** Each summer term  
**Version** 1

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<tr>
<td>SS 2018</td>
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<td>Experimental Lab Course in Material Science</td>
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<td>SS 2018</td>
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<td>Materials Science and Engineering Lab Course</td>
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<td>Heilmaier</td>
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**Competence Certificate**  
Oral colloquium at the beginning of each topic; certificate of successful attendance.

**Prerequisites**  
none

**Annotation**  
The workload for the lab course Materials Science is 90 h in total and consists of the presence during the 10 experiments (one week half-time, 4 hours per day) as well as preparation and rework time at home.

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

**Experimental Lab Course in Material Science**  
2174597, SS 2018, 3 SWS, Open in study portal

**Learning Content**  
Performing and evaluating of two laboratory experiments in each of the following topics:

- Mechanical testing of materials  
- Nonmetallic materials  
- Microstructure and properties  
- Cyclic loading / fatigue  
- Influence of manufacturing technique on materials

**Workload**  
regular attendance: 22 hours  
self-study: 68 hours

**Literature**  
Laboratory script;  
Shackelford, J.F.  
Werkstofftechnologie für Ingenieure  
Verlag Pearson Studium, 2005
3.148 Course: Mathematical Methods in Dynamics [T-MACH-105293]

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

Part of: M-MACH-102582 - Schwerpunkt: Kontinuumsmechanik
M-MACH-102746 - Wahlpflichtmodul
M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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<td>WS 18/19 2161207 Übungen zu Mathematische Methoden der Dynamik 1 SWS Practice (Ü) Koebele, Proppe</td>
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Exams

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Competence Certificate
written examination, 180 min.

Prerequisites
none

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

**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:
Principle of virtual work, variational calculations, Principle of Hamilton

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Workload

Lectures and exercises: 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


Übungen zu Mathematische Methoden der Dynamik
2161207, WS 18/19, 1 SWS, Open in study portal

Learning Content
Exercises related to the lecture
### 3.149 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-102746 - Wahlpflichtmodul

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**Events**

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<th>Version</th>
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<td>Lecture (V)</td>
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<td>1 SWS</td>
<td>Practice (Ü)</td>
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<td>SS 2018</td>
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<td>Mathematical Methods in Fluid Mechanics</td>
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<td>Tutorial in Mathematical Methods of Fluid Mechanics</td>
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<td>Mathematical Methods in Fluid Mechanics</td>
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**Competence Certificate**

written examination - 3 hours

**Prerequisites**

none

**Recommendation**

Basic Knowledge about Fluid Mechanics

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

**Mathematical Methods in Fluid Mechanics**

2154432, SS 2018, 2 SWS, [Open in study portal](https://example.com)

**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**

Tutorial in Mathematical Methods of Fluid Mechanics
2154433, SS 2018, 1 SWS, Open in study portal

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
Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge
Mathematical Library, 2000

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

Part of:  M-MACH-102582 - Schwerpunkt: Kontinuumsmechanik
M-MACH-102746 - Wahlpflichtmodul

Type                  Prüfung
Credits: 5
Recurrence: Each winter term
Version: 4

Events

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<td>76-T-MACH-100297</td>
<td>Mathematical Methods in Strength of Materials</td>
<td>Prüfung (PR)</td>
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</table>

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:

Mathematical Methods in Strength of Materials
2161254, WS 18/19, 2 SWS, Open in study portal

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
3 COURSES

Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

3.151 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-102746 - Wahlpflichtmodul
- M-MACH-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik
- M-MACH-104442 - Schwerpunkt: Schwingungslehre

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Competence Certificate
written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

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

### Lecture (V)

**Mathematical methods of vibration theory**
2162241, SS 2018, 2 SWS, Open in study portal

**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

### Practice (Ü)

**Mathematical methods of vibration theory (Tutorial)**
2162242, SS 2018, 2 SWS, Open in study portal

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

**Workload**
time of attendance: 10,5h; self-study: 20h

Mechanical Engineering Bachelor (2016)
Module Handbook as of 01.04.2019
Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik
3.152 Course: Mathématiques appliquées aux sciences de l'ingénieur [T-MACH-105452]

**Responsible:** Prof. Dr. Jean-Yves Dantan  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102746 - Wahlpflichtmodul

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<td>Mathématiques appliquées aux sciences de l'ingénieur</td>
<td>Prüfung (PR)</td>
<td>Böhlke</td>
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**Competence Certificate**
oral exam, 30 min.

**Prerequisites**
none

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

Mathématiques appliquées aux sciences de l'ingénieur
2161230, SS 2018, 4 SWS, Open in study portal

**Learning Content**
Courses are taught in French.
First block course at the KIT:
Basics of probability theory and Laplace transformation
Second block course at the Arts et Métiers ParisTech, centre Metz, France
Application of mathematics in the fields of functional safety of structural components, reliability of components and systems, vibrations and control systems.
A visit to an industry partner in the vicinity of Metz will be planned.

**Annotation**
The second block course will probably take place 1-2 days in Metz. KIT-DeFI will be responsible for the organisation and bear the expenses for the students interested.

**Workload**
General attendance: 21 h
Self-study: 129 h
Learning Content
Courses are taught in French.
First block course at the KIT:
Basics of probability theory and Laplace transformation
Second block course at the Arts et Métiers ParisTech, centre Metz, France
Application of mathematics in the fields of functional safety of structural components, reliability of components and systems, vibrations and control systems.
A visit to an industry partner in the vicinity of Metz will be planned.

Annotation
The second block course will probably take place 1-2 days in Metz. KIT-DeFI will be responsible for the organisation and bear the expenses for the students interested.

Workload
General attendance: 21 h
Self-study: 129 h
### 3.153 Course: Measurement II [T-MACH-105335]

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

**Part of:**  
M-MACH-102817 - Schwerpunkt: Informationstechnik  
M-MACH-102820 - Schwerpunkt: Mechatronik

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**Events**

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**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:

#### 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
3 COURSES
Course: Mechanical Design I & II [T-MACH-105286]

### 3.154 Course: Mechanical Design I & II [T-MACH-105286]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102573 - Maschinenkonstruktionslehre

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**Exams**

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<td>7</td>
<td>Each winter term</td>
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**Competence Certificate**
written exam, graded, duration: 60 min

**Prerequisites**
Admission to the exam only with successful completion of the T-MACH-105282 - Mechanical Design I, prerequisites and T-MACH-105283 - Mechanical Design II, prerequisites.

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

1. The course T-MACH-105282 - Mechanical Design I, prerequisites must have been passed.
2. The course T-MACH-105283 - Mechanical Design II, prerequisites must have been passed.

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

### Mechanical Design II
2146178, SS 2018, 2 SWS, Open in study portal

**Description**

**Media:**
- Beamer
- Visualizer

**Learning Content**
- Mechanical components
- Bearings
- Sealings
- Design
- Tolerances and fittings
- Shaft-hub connections

Tutorials take place in concomitant to the lectures.
Annotation
Lecture notes:
The Product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Workload
regular attendance: 42 h
self-study: 80 h

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X ,
also available as electronic paper at the KIT catalogue.
Grundlagen von Maschinenelementen für Antriebsaufgaben;

Mechanical Design I
2145178, WS 18/19, 2 SWS, Open in study portal

Description
Media:
Beamer
Visualizer
Mechanical components

Learning Content
Introduction in product development
Tools for visualization (technical drawing)
Product generation as a problem solving process
Technical systems for Product generation
  • systems theory
  • Contact and Channel Approach C&C²-A

Basics of selected technical components
  • springs
  • bearings

Concommitant to the lectures tutorials take place with the following contents:
Gear workshop
Tutorial "tools of visualization (technical drawing)"
Tutorial "technical systems product development, sytem theory, Contact and Channel Approach - C&C²-A"
Tutorial "springs"
Tutorial "bearing and bearing arrangements"

Annotation
Lecture notes:
The Product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in ILIAS.

Workload
regular attendance: 42 h
self-study: 80 h
Literature

Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.

Literature:

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

or per full text access provided by university library

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

Mechanical Design I (Lecture)
3145186, WS 18/19, 2 SWS, Open in study portal

Description

Media:
Beamer
Visualizer
Mechanical components

Learning Content

Introduction in product development
Tools for visualization (technical drawing)
Product generation as a problem solving process
Technical systems for Product generation
  • systems theory
  • Contact and Channel Approach C&C²-A

Basics of selected technical components
  • springs
  • bearings

Concomitant to the lectures tutorials take place with the following contents:
Gear workshop
Tutorial "tools of visualization (technical drawing)"
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Tutorial "springs"
Tutorial "bearing and bearing arrangements"

Annotation

Lecture notes:
The Productdevelopment knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in ILIAS.

Workload

regular attendance: 42 h
self-study: 80 h
Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.

Literature:
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8
3.155 Course: Mechanical Design I, prerequisites [T-MACH-105282]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102573 - Maschinenkonstruktionslehre

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Events

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Exams

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<td>Albers, Matthiesen</td>
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Competence Certificate

Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

Furthermore an online test is carried out.

Prerequisites

none

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

Tutorials Mechanical Design I

2145185, WS 18/19, 1 SWS, Open in study portal

Description

Media:
Beamer
Visualizer
Gear box (Workshop)

Learning Content

Gear workshop
Tutorial "tools of visualization (technical drawing)"
Tutorial "technical systems product development, sytem theory, Contact and Channel Approach - C&C²-A"
Tutorial "springs"
Tutorial "bearing and bearing arrangements"

Workload

lectures: 10.5 h
preparation to exam: 49.5 h
Literature

**Konstruktionselemente des Maschinenbaus - 1 und 2**
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

**Grundlagen von Maschinenelementen für Antriebsaufgaben**;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

**CAD:**
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

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**Mechanical Design I (Tutorial)**
3145187, WS 18/19, 2 SWS, [Open in study portal]

**Description**
**Media:**
Beamer
Visualizer
Gear box (Workshop)

**Learning Content**
Gear workshop
Tutorial "tools of visualization (technical drawing)"
Tutorial "technical systems product development, sytem theory, Contact and Channel Approach - C&C²-A"
Tutorial "springs"
Tutorial "bearing and bearing arrangements"

**Workload**
lectures: 10.5 h
preparation to exam: 49.5 h

**Literature**

**Konstruktionselemente des Maschinenbaus - 1 und 2**
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

**Grundlagen von Maschinenelementen für Antriebsaufgaben**;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

**CAD:**
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)
3.156 Course: Mechanical Design II, prerequisites [T-MACH-105283]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102573 - Maschinenkonstruktionslehre

### Events

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<td>Tutorials Mechanical Design II</td>
<td>Practice (Ü)</td>
<td>2 SWS</td>
<td>Beamer, Visualizer, model box (Workshop)</td>
<td>Bearings, Sealings, Design, Tolerances and fittings, Shaft-hub connections</td>
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**Competence Certificate**

Concomitant to the lecture, 2 online tests are carried out and the knowledge from the lecture will be tested. The knowledge from mechanical design I and II will further be controlled with a design and a CAD task.

**Prerequisites**

None

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

### Tutorials Mechanical Design II

2146185, SS 2018, 2 SWS, Open in study portal

**Description**

**Media:**

- Beamer
- Visualizer
- model box (Workshop)

**Learning Content**

- Bearings
- Sealings
- Design
- Tolerances and fittings
- Shaft-hub connections

**Workload**

- Lectures: 21 h
- Preparation to exam: 39 h
Literature

Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)
### 3.157 Course: Mechanical Design III & IV [T-MACH-104810]

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

**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-102573 - Maschinenkonstruktionslehre

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<td>2 SWS</td>
<td>Lecture (V)</td>
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<td>Mechanical Design III (Lecture)</td>
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### Competence Certificate

Written exam consisting of:

- written part duration 60 min and  
- design part duration 180 min

Sum: 240 min

### Prerequisites

Admission to the exam only with successful completion of the T-MACH-105284 - Mechanical Design III, Constructing the Team and T-MACH-105285 - Mechanical Design IV, Constructing the Team.

### Modeled Conditions

You have to fulfill one of 2 conditions:

1. The course T-MACH-105284 - Mechanical Design III, Constructing the Team must have been passed.  
2. The course T-MACH-105285 - Mechanical Design IV, Constructing the Team must have been passed.

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

#### Mechanical Design IV

2146177, SS 2018, 2 SWS, Open in study portal

**Description**

**Media:**  
- Beamer  
- Visualizer  
- Mechanical components
Learning Content
Basic connections - part 2

Coupling fundamentals
Function and working principles
Significant characteristics and classification
Non-shiftable shaft couplings
Shiftable shaft couplings
Elastic couplings

Gear transmission fundamentals
Function and working principles
Fundamentals of gear transmissions
Significant characteristics and classification
Selection criteria
Fundamentals of further gear drives
Fundamentals of lubrication and lubricants

Tooth system fundamentals
Function and working principles
Tooth pitch characters
Cycloid as slope curve
Evolvent as slope curve
Manufacturing technologies
Transverse contact ratio
Profile offset
Application limits and technical defects
Dimensioning
Root bearing
Flank bearing

Hydraulic fundamentals
Basic functions and working principles
Significant characteristics and classification
Model types and characteristics
Selection criteria
Application
Dimensioning

Annotation
Lecture notes:
The product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Illias.

Workload
regular attendance: 42 h
self-study: 80 h

Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Illias.

Literature:
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3(für Fortgeschrittene)
Description
Media:
- Beamer
- Visualizer
- Mechanical components

Learning Content
- component connection
- Tolerances and fittings
- gears

Annotation
Lecture notes:
The Product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Workload
- regular attendance: 42 h
- self-study: 80 h

Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.

Literature:
or full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben; Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V Mechanical Design III (Lecture)
3145016, WS 18/19, 2 SWS, Open in study portal

Description
Media:
- Beamer
- Visualizer
- Mechanical components

Learning Content
- component connection
- Tolerances and fittings
- gears

Annotation
Lecture notes:
The Product development knowledge base PKB will be provided in digital form for registered students. All lecture notes and additional slides will be provided in Ilias.

Workload
- regular attendance: 42 h
- self-study: 80 h
Literature
Lecture notes:
The lecture notes can be downloaded via the eLearning platform Ilias.

Literature:
*Konstruktionselemente des Maschinenbaus* - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;
or per full text access provided by university library
Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3(für Fortgeschrittene)
Course: Mechanical Design III, Constructing the Team [T-MACH-105284]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102573 - Maschinenkonstruktionslehre

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**Competence Certificate**
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

**Prerequisites**
None

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

**Tutorials Mechanical Design III**
2145153, WS 18/19, 2 SWS, Open in study portal

**Description**
- **Media:**
  - Beamer
  - Visualizer
  - model box (Workshop)

**Learning Content**
- component connection
- Tolerances and fittings
- gears
Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V Mechanical Design III Workshop
2145154, WS 18/19, 1 SWS, Open in study portal

Learning Content
Interrogation of the purchased knowledge in mechanical design by means of the workshop task.

Annotation
Bonus
The student can achieve an extra bonus for the mechanical design exam.
The bonus amounts to 0.3 exam points and it can only be achieved in case of passed MD-exam (lowest passing grade 4.0).
More details will be announced in mechanical design III and IV.

Workload
regular attendance: 21 h
self-study: 39 h

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von
Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

V Mechanical Design III (Tutorial)
3145017, WS 18/19, 2 SWS, Open in study portal

Description
Media:
Beamer
Visualizer
model box (Workshop)

Learning Content
component connection
Tolerances and fittings
gears
Learning Content
Interrogation of the purchased knowledge in mechanical design by means of the workshop task.

Annotation
Bonus
The student can achieve an extra bonus for the mechanical design exam. The bonus amounts to 0.3 exam points and it can only be achieved in case of passed MD-exam (lowest passing grade 4.0). More details will be announced in mechanical design III.

Workload
regular attendance: 21 h
self-study: 39 h

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)
### T 3.159 Course: Mechanical Design IV, Constructing the Team [T-MACH-105285]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102573 - Maschinenkonstruktionslehre

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**Competence Certificate**
Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled. The pass of the colloquia and the process of the workshop task are required for the successful participation.

**Prerequisites**
None

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

### V 2146184, SS 2018, 2 SWS, Open in study portal

**Tutorials Mechanical Design IV**

**Description**

**Media:**
- Beamer
- Visualizer
- Model box (Workshop)

**Learning Content**
- Basic connections - part 2
- Coupling fundamentals
- Gear transmission fundamentals
- Tooth system fundamentals
- Hydraulic fundamentals

**Workload**
- Lectures: 10.5 h
- Preparation to exam: 49.5 h
Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)

Workshop 'Mechanical Design IV'
2146187, SS 2018, 1 SWS, Open in study portal

Learning Content
Interrogation of the purchased knowledge in mechanical design by means of the workshop task.

Annotation
Bonus
The student can achieve an extra bonus for the mechanical design exam.
The bonus amounts to 0.3 exam points and it can only be achieved in case of passed MD-exam (lowest passing grade 4.0).
More details will announce in mechanical design IV.

Workload
lectures: 10.5 h
preparation to exam: 19.5 h

Literature
Konstruktionselemente des Maschinenbaus - 1 und 2
Grundlagen der Berechnung und Gestaltung von Maschinenelementen;

Grundlagen von Maschinenelementen für Antriebsaufgaben;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3 (für Fortgeschrittene)
3.160 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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<td>Mechanics and Strengths of Polymers</td>
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<td>von Bernstorff</td>
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Competence Certificate  
Oral exam, about 25 minutes

Prerequisites  
none

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

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

Mechanics and Strengths of Polymers  
2173580, WS 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.
3.161 Course: Mechanics in Microtechnology [T-MACH-105334]

**Responsible:** Dr. Christian Greiner  
Dr. Patric Gruber

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102820 - Schwerpunkt: Mechatronik

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

**Prerequisites**
none

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

**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 Mechanical Parameters such as Young's Modulus and Yield Strength; Thin Film Adhesion and Stiction  
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Electrostatics,...  
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Elektromagnetic Actuation,...

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

**Literature**
Folien,  
2. L.B. Freund and S. Suresh: "Thin Film Materials"  
3.162 Course: Metallographic Lab Class [T-MACH-105447]

**Responsible:** Ulla Hauf  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Competence Certificate**  
Colloquium for every experiment, about 60 minutes, protocol

**Prerequisites**  
M-MACH-102562 - Materials Science must be passed.

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

1. The module M-MACH-102562 - Materials Science must have been passed.

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

**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  
Literature List will be handed out with each experiment
3 COURSES

Course: Micro- and nanosystem integration for medical, fluidic and optical applications [T-MACH-108809]

3.163 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-102820 - Schwerpunkt: Mechatronik

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**Events**

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<td>2105032</td>
<td>Micro- and nanosystem integration for medical, fluidic and optical applications</td>
<td>2</td>
<td>Lecture (V)</td>
<td>Koker, Gengenbach, Sieber</td>
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</table>

**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:

**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
Course: Microenergy Technologies [T-MACH-105557]

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

**Part of:**  
M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik  
M-MACH-102820 - Schwerpunkt: Mechatronik

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<td>Microenergy Technologies</td>
<td>Prüfung (PR)</td>
<td>Kohl</td>
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**Competence Certificate**

Oral examination (30 Min.)

**Prerequisites**

none

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

**Microenergy Technologies**

2142897, SS 2018, 2 SWS, [Open in study portal](#)

**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"
3.165 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-102746 - Wahlpflichtmodul

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</table>

Competence Certificate

Written exam, 90 min

Prerequisites

none

Recommendation

preliminary knowledge in mathematics, physics and materials science

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

Modelling and Simulation

2183703, SS 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

Numerical methods and simulation techniques
2183703, WS 18/19, 3 SWS, Open in study portal

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
3.166 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-102746 - Wahlpflichtmodul
M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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<td>August, Nestler, Weygand</td>
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Competence Certificate
oral exam 30 min

Prerequisites
none

Recommendation
materials science
fundamental mathematics

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

Modelling of Microstructures
2183702, WS 18/19, 3 SWS, Open in study portal

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

4. Gaskell, D.R., Introduction to the thermodynamics of materials
5. Problem sheets
3.167 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-102820 - Schwerpunkt: Mechatronik

Type
Prüfungsleistung schriftlich

Credits
4

Recurrence
Each summer term

Version
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:

Modern Control Concepts I

2105024, SS 2018, 2 SWS, Open in study portal

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

3.168 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-102812 - Schwerpunkt: Antriebssysteme
M-MACH-102820 - Schwerpunkt: Mechatronik

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Competence Certificate
oral exam (30 Min.)

Prerequisites
none

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

Novel actuators and sensors
2141865, WS 18/19, 2 SWS, Open in study portal

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
- Magnetostriuctive 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
**Objective**

Dr.-Ing. Franco Magagnato

**Organisation**

KIT Department of Mechanical Engineering

**Part of**

M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

**Events**

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**Competence Certificate**

oral exam - 30 minutes

**Prerequisites**

none

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

**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**

3.170 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-102645 - Schwerpunkt: Technik des Verbrennungsmotors

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**Competence Certificate**  
oral exam, 15 min

**Prerequisites**  
none

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

**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
3.171 Course: Photovoltaics [T-ETIT-101939]

**Responsible:** Prof. Dr.-Ing. Michael Powalla

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

**Part of:** M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

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**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.

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

**Part of:** M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

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**Events**

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**Exams**

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

**Prerequisites**  
one

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

**Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle**  
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)
3.173 Course: Physical Basics of Laser Technology [T-MACH-102102]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102746 - Wahlpflichtmodul

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Competence Certificate
oral examination (30 min)

no tools or reference materials

**Prerequisites**
It is not possible to combine this brick with brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

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

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.

**Recommendation**
Basic knowledge of physics, chemistry and material science

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

**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
- safety 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
# 3.174 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-102746 - Wahlpflichtmodul

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### Competence Certificate
written exam 90 min

### Prerequisites
none

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

**Physics for Engineers**  
2142890, SS 2018, 2 SWS, [Open in study portal](#)
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
   - Harris, Moderne Physik, Pearson Verlag, 2013
### 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-102583 - Schwerpunkt: Informationsmanagement

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### Competence Certificate

Oral examination 20 min.

### Prerequisites

none

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

**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.
### 3.176 Course: PLM-CAD Workshop [T-MACH-102153]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102583 - Schwerpunkt: Informationsmanagement

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**Competence Certificate**  
Alternative exam assessment (graded)

**Prerequisites**  
None

**Annotation**  
Number of participants is limited, compulsory attendance
3.177 Course: Polymer Engineering I [T-MACH-102137]

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

**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

None

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

**Polymer Engineering I**  
2173590, WS 18/19, 2 SWS, Open in study portal

**Learning Content**

1. Economical aspects of polymers  
2. Introduction of mechanical, chemical and electrical properties  
3. Processing of polymers (introduction)  
4. Material science of polymers  
5. Synthesis

**Workload**

Regular attendance: 21 hours  
Self-study: 99 hours

**Literature**

Recommended literature and selected official lecture notes are provided in the lecture.
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-102812 - Schwerpunkt: Antriebssysteme
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**

written examination: 60 min duration

**Prerequisites**

None

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

**Powertrain Systems Technology A: Automotive Systems**

2146180, SS 2018, 2 SWS, [Open in study portal]

**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
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-102812 - Schwerpunkt: Antriebssysteme
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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**Competence Certificate**
written examination: 60 min duration

**Prerequisites**
None

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

**Powertrain Systems Technology B: Stationary Machinery**
2145150, WS 18/19, 2 SWS, Open in study portal

**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
3.180 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-104442 - Schwerpunkt: Schwingungslehre

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**Competence Certificate**

Colloquium to each session, 10 out of 10 colloquiums must be passed

**Prerequisites**

Can not be combined with Experimental Dynamics (T-MACH-105514).

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105514 - Experimental Dynamics must not have been started.

**Recommendation**

Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations
**3.181 Course: Presentation [T-MACH-109189]**

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104494 - Bachelorarbeit

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**Competence Certificate**

The colloquium presentation must be held within 6 weeks after the submission of the bachelor thesis. The presentation should last around 20 minutes followed by a scientific discussion with the present expert audience. The students should show that they are able to independently present and discuss the content of their bachelor thesis according to scientific criteria.

**Prerequisites**

Bachelor Thesis has been started

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-109188 - Bachelor Thesis must have been started.

**Annotation**

The workload for the presentation of the bachelor thesis is about 90 hours.
3 COURSES
Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

3.182 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-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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Competence Certificate

The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites

none

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

Basic principles of powder metallurgical and ceramic processing

2193010, WS 18/19, 2 SWS, Open in study portal

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.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
3.183 Course: Product Lifecycle Management [T-MACH-105147]

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

Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement
M-MACH-102589 - Schwerpunkt: Produktionssysteme
M-MACH-102746 - Wahlpflichtmodul

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Exams
| SS 2018    | 76-T-MACH-105147 | Prüfung (PR) | Ovtcharova |
| WS 18/19   | 76-T-MACH-105147 | Prüfung (PR) | Ovtcharova |

Competence Certificate
Written examination 90 min.

Prerequisites
None

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

Product Lifecycle Management
2121350, WS 18/19, 2 SWS, Open in study portal

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.


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

3.184 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-102583 - Schwerpunkt: Informationsmanagement
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

**Type**
Prüfungsleistung mündlich

**Credits**
4

**Recurrence**
Each summer term

**Version**
2

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**Competence Certificate**
Oral examination 20 min.

**Prerequisites**
None

**Annotation**
Limited number of participants.

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

**Product, Process and Resource Integration in the Automotive Industry**

**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 work and distributed development.

**Annotation**
Max. 20 students, registration necessary (ILIAS)
Workload
regular attendance: 32 hours
self-study: 72 hours

Literature
Lecture slides
### 3.185 Course: Production and Logistics Controlling [T-WIWI-103091]

**Responsible:** Alexander Rausch  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-MACH-102821 - Schwerpunkt: Technische Logistik

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**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:*

#### Produktions- und Logistikcontrolling

2500005, WS 18/19, 2 SWS, [Open in study portal](#)

**Learning Content**

1. Overview of Controlling  
2. Performance Measurement  
3. Planning  
4. Reporting  
5. Deviation Analysis
3.186 Course: Production Operations Management [T-MACH-100304]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza
Prof. Dr. Frank Schultmann

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-100297 - Betriebliche Produktionswirtschaft

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**Events**

**SS 2018**
2110085 Production Operations Management 4 SWS Lecture / Practice (VÜ) Furmans, Lanza

**WS 18/19**
2110085 Production Operations Management 2 SWS Lecture / Practice (VÜ) Furmans, Lanza

3118031 Production Operations Management 3 SWS Lecture / Practice (VÜ) Furmans, Lanza

**Exams**

**SS 2018**
76-T-MACH-100304 Production Operations Management Prüfung (PR) Furmans, Lanza

**WS 18/19**
76-T-MACH-100304 Production Operations Management Prüfung (PR) Furmans, Lanza, Deml

**Competence Certificate**
written exam (duration: 90 min)

**Prerequisites**
T-MACH-108734 - Production Operations Management-Project must have been completed successfully.

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

1. The course T-MACH-108734 - Production Operations Management-Project must have been passed.

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

**Production Operations Management**
2110085, SS 2018, 4 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 is given in cooperation by the Institute for Conveying Technologies and Logistics (IFL) and the Institute of Production Science (wbk). Basic skills are taught about the planning and operation of a production system. Contents of the lecture are the basics of operational and supply chain management as well as business administration basics for accounting, investment calculation and legal forms.

**Annotation**
None

**Workload**
regular attendance: 42 hours
self-study: 108 hours
Literature
Lecture Notes

Production Operations Management
2110085, WS 18/19, 2 SWS, Open in study portal

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

Learning Content
The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms.

Annotation
It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK). The institutes alternate with each cycle.

Workload
regular attendance: 25 hours
self-study: 65 hours

Literature
3.187 Course: Production Operations Management-Project [T-MACH-108734]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Gisela Lanza

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-100297 - Betriebliche Produktionswirtschaft

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**Competence Certificate**

Assignments during the semester consisting of solving 5 and presenting 2 case studies, whereof:

- 80% assessment of the case study as group work
- 20% oral examination during case study colloquiums

**Prerequisites**

none

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

**Production Operations Management-Project**

2110086, WS 18/19, 1 SWS, Open in study portal

**Learning Content**

Students are divided into groups for this course. Five case studies will be carried out in these groups. The results of the group work will be presented and evaluated in writing. In addition, selected groups will present and defend their results. In the defences, the understanding of the models dealt with in the lecture is also tested.

The participation of all members of the selected groups in the oral defences is compulsory and controlled. Four written submissions must be passed and the best four out of five will be evaluated. For the written submission the group receives a common mark, in the defense each group member is evaluated individually. The defences are fully included in the evaluation, but they do not have to be passed in order to pass the lecture. The final score of the event consists of 80% of the written submissions and 20% of the defence evaluation.

**Annotation**

It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (WBK). The institutes alternate with each cycle.

**Workload**

Attendance time: 17 hours,
Self-study: 43 hours

**Literature**

3.188 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-102583 - Schwerpunkt: Informationsmanagement
M-MACH-102812 - Schwerpunkt: Antriebssysteme
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik
M-MACH-102820 - Schwerpunkt: Mechatronik

Type
Prüfungsleistung mündlich
Credits 4
Recurrence Each winter term
Version 1

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Competence Certificate
oral exam (20 min)
Aids: None

Prerequisites
none

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

Project management in Global Product Engineering Structures
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
**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-102638 - Schwerpunkt: Bahnsystemtechnik

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**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:*

**Project Management in Rail Industry**

**2115995, WS 18/19, 2 SWS, Open in study portal**

**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 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).
3.190 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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**Competence Certificate**

Oral examination  
Duration: 30 up to 40 minutes  
Auxiliary means: none

**Prerequisites**

none

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

**Project Workshop: Automotive Engineering**  
2115817, SS 2018, 3 SWS, [Open in study portal]

**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**

The scripts will be supplied in the start-up meeting.

---

**Project Workshop: Automotive Engineering**

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**

The scripts will be supplied in the start-up meeting.
3.191 Course: Quality Management [T-MACH-102107]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-102589 - Schwerpunkt: Produktionssysteme
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102821 - Schwerpunkt: Technische Logistik

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

**Prerequisites**
none

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

**Quality Management**
2149667, WS 18/19, 2 SWS, [Open in study portal](https://ilias.studium.kit.edu/)

**Description**

**Media:**
Lecture notes will be provided in Ilias ([https://ilias.studium.kit.edu/](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-specific 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 service-related quality management. The content is completed with the presentation of certification possibilities and legal quality aspects.

Main topics of the lecture:
- The term "quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

**Annotation**
None

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

Course: Rail System Technology [T-MACH-106424]

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

Part of: M-MACH-102638 - Schwerpunkt: Bahnsystemtechnik

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<td>2 SWS</td>
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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:

Rail System Technology
2115919, SS 2018, 2 SWS, Open in study portal

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).
Rail System Technology
2115919, WS 18/19, 2 SWS, Open in study portal

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

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

**Part of:** M-MACH-102638 - Schwerpunkt: Bahnsystemtechnik

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**Exams**

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**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:

**Rail Vehicle Technology**  
2115996, SS 2018, 2 SWS, [Open in study portal]

**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).
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
   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).
3.194 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-102638 - Schwerpunkt: Bahnsystemtechnik

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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:

Railways in the Transportation Market
2114914, SS 2018, 2 SWS, Open in study portal

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
### Course: Reliability Engineering 1 [T-MACH-107447]

**Responsible:** Dr.-Ing. Alexei Konnov  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:**  
- M-MACH-102817 - Schwerpunkt: Informationstechnik  
- M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Competence Certificate**

written exam

**Prerequisites**

none

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

#### Reliability Engineering 1  
2169550, SS 2018, 2 SWS, [Open in study portal](#)

**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 attendance: 25 h  
- self-study: 65 h

**Literature**

Lesson script (link will be available)  
Recommended books:  
- Birolini, Alessandro: *Reliability Engineering Theory and Practice*  
- Pham, Hoang: *Handbook of reliability engineering*

#### Reliability Engineering 1  
2169550, WS 18/19, 2 SWS, [Open in study portal](#)
Workload
regular attendence: 25 h
self-study: 65 h

Literature
Lesson script (link will be available)
Recommended books:
- Birolini, Alessandro: *Reliability Engineering Theory and Practice*
- Pham, Hoang: *Handbook of reliability engineering*
### 3.196 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-102820 - Schwerpunkt: Mechatronik

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#### Exams

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</table>
Course: Safety Engineering [T-MACH-105171]

Responsible: Hans-Peter Kany
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
M-MACH-102821 - Schwerpunkt: Technische Logistik

Type: Prüfungsleistung mündlich
Credits: 4
Recurrence: Each winter term
Version: 2

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

Prerequisites
none

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

**Safety Engineering**
2117061, WS 18/19, 2 SWS, [Open in study portal]

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
3 COURSES

3.198 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-102746 - Wahlpflichtmodul

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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).

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

Scientific computing for Engineers
2181738, WS 18/19, 2 SWS, Open in study portal

Learning Content
1. Introduction: why scientific computing
2. computer architectures
3. Introduction to Unix/Linux
4. Foundations of C++
   * program 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, Knapec, Zumbusch, Caglar, Springer Verlag

Introduction to scientific computing
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)
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-102821 - Schwerpunkt: Technische Logistik

Type: Prüfungsleistung mündlich
Credits: 4
Recurrence: Each summer term
Version: 1

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

Prerequisites
none

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:

Selected Applications of Technical Logistics
2118087, SS 2018, 3 SWS, Open in study portal

Description
Media:
supplementary sheets, projector, blackboard

Notes
Details according to 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
3.200 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-102821 - Schwerpunkt: Technische Logistik

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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
3.201 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

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

Selected Problems of Applied Reactor Physics and Exercises
2190411, SS 2018, 2 SWS, Open in study portal

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)
3.202 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-102638 - Schwerpunkt: Bahnsystemtechnik

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Competence Certificate
Examination: Writing a Seminararbeit, final presentation

Prerequisites
none

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

Seminar for Rail System Technology
2115009, SS 2018, SWS, Open in study portal

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).
Seminar for Rail System Technology
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 (milestones), 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).
### 3.203 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-102820 - Schwerpunkt: Mechatronik

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<td>2 SWS</td>
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**Prerequisites**

none
**3.204 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-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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**Prerequisites**  
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

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

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

**Recommendation**

- Knowledge of ProE (ideally in actual version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics
Annotation
After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

Content:

- Basics of multi-body and hydraulics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

Literature:
Software guide books (PDFs)
Information about wheel-type loader specifications

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

Simulation of Coupled Systems
2114095, SS 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
3.205 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-104430 - Schwerpunkt: Modellbildung und Simulation in der Dynamik

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Competence Certificate
Preparation of semester report

Prerequisites
none
3.206 Course: SmartFactory@Industry (MEI) [T-MACH-106733]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102644 - Schwerpunkt: Production Engineering

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Competence Certificate
alternative test achievement (graded)
  • colloquium (approx. 15 min)
  • presentation (approx. 20 min)

Prerequisites
Successful completion of the following courses:
  • M-MACH-102563 - Computer Science
  • MACH-102573 - Mechanical Design

Modeled Conditions
The following conditions have to be fulfilled:
1. The module M-MACH-102563 - Computer Science must have been passed.
2. The module M-MACH-102573 - Mechanical Design must have been passed.

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

SmartFactory@Industry
3150044, SS 2018, 2 SWS, Open in study portal

Learning Content
The students will get to know different real industrial tasks and problems and will learn how to address them with the methods they got to know and even beyond these.

Annotation
For organizational reasons the number of participants for the course is limited. Hence a selection process will take place.

The course is held as block modules.
3.207 Course: Solar Thermal Energy Systems [T-MACH-106493]

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

**Part of:** M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

### Events

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### Competence Certificate

oral exam. 30 minutes

### Prerequisites

none

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

**Solar Thermal Energy Systems**  
2189400, WS 18/19, SWS, Open in study portal

### 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
3.208 Course: Strategic product development - identification of potentials of innovative products [T-MACH-105696]

**Responsibilities:**
Dr.-Ing. Andreas Siebe

**Organisation:**
KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-102812 - Schwerpunkt: Antriebssysteme
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

**Type**
Prüfungsleistung mündlich

**Credits**
4

**Recurrence**
Each summer term

**Version**
1

**Events**

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

**Prerequisites**
none

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

**Strategic product development - identification of potentials of innovative products**
2146198, SS 2018, 2 SWS, Open in study portal

**Learning Content**
Introduction into future management, Development of scenarios, sceneriobased 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
3.209 Course: Supply Chain Management [T-MACH-105181]

Responsible: Dr.-Ing. Knut Alicke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102583 - Schwerpunkt: Informationsmanagement

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

Prerequisites
none

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

Supply chain management

2117062, WS 18/19, 3 SWS, [Open in study portal]

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


### Course: Sustainable Product Engineering [T-MACH-105358]

**Responsible:** Dr. Karl-Friedrich Ziegahn  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
- M-MACH-102583 - Schwerpunkt: Informationsmanagement  
- M-MACH-102812 - Schwerpunkt: Antriebssysteme  
- M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
- M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik  
- M-MACH-102820 - Schwerpunkt: Mechatronik

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

**Prerequisites**

none

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

#### 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 simulation during the process of development 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
3.211 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

**Responsible:** Dr. Ulrich Gengenbach

**Organisation:** KIT Department of Mechanical Engineering

Part of: M-MACH-102820 - Schwerpunkt: Mechatronik

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

**Prerequisites**
none

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

**System Integration in Micro- and Nanotechnology**
2106033, SS 2018, 2 SWS, Open in study portal

**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

- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013
3.212 Course: Systematic Materials Selection [T-MACH-100531]

**Responsible:** Dr.-Ing. Stefan Dietrich  
**Organisation:** KIT Department of Mechanical Engineering

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### Events

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**Competence Certificate**  
The assessment is carried out as a written exam of 2 h.

**Prerequisites**  
M-MACH-102562 - Materials Science must be passed.

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

1. The module M-MACH-102562 - Materials Science must have been passed.

**Recommendation**  
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

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

### Systematic Materials Selection

**2174576, SS 2018, 3 SWS, Open in study portal**  
**Lecture (V)**

**Learning Content**  
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are developed. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

**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
3.213 Course: Technical Design in Product Development [T-MACH-105361]

Responsible: Markus Schmid
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion

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Competence Certificate
Written exam (20 min)
Only dictionary is allowed

Prerequisites
none

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

Technical Design in Product Development
2146179, SS 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
3.214 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-104747]

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

Part of: M-MACH-102574 - Technische Thermodynamik

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Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105204 - Exercises in Technical Thermodynamics and Heat Transfer I)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Exercises in Technical Thermodynamics and Heat Transfer I must have been passed.

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

Description
Media:
Blackboard and Powerpoint presentation

Learning Content
System, properties of state
Absolute temperature, model systems
1st law of thermodynamics for resting and moved systems
Entropy and 2nd law of thermodynamics
Behavior of real substances described by tables, diagrams and equations of state
Machine processes

Workload
Regular attendance: 56.3 h
Self-study: 183.8 h
Literature
Course note packet
### Course: Technical Thermodynamics and Heat Transfer II [T-MACH-105287]

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

**Part of:** M-MACH-102574 - Technische Thermodynamik

#### Type
- Prüfungsleistung schriftlich

#### Credits
- 7

#### Recurrence
- Each summer term

#### Version
- 1

#### Events

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**Competence Certificate**
- Written exam [duration: 180 min]

**Prerequisites**
- Successful participation in the tutorial (T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II)

**Modeled Conditions**
- The following conditions have to be fulfilled:
  1. The course T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II must have been passed.

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

##### Technical Thermodynamics and Heat Transfer II

**2166526, SS 2018, 3 SWS, Open in study portal**

**Lecture (V)**

**Description**
- Media:
  - Blackboard and Powerpoint presentation

**Learning Content**
- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Mixtures of ideal gases
- Moist air
- Behaviour of real substances described by equations of state
- Applications of the laws of thermodynamics to chemical reactions

**Workload**
- Regular attendance: 52.5 hours
- Self-study: 142.5 hours
Literature

Course notes


3.216 Course: Technology of Steel Components [T-MACH-105362]

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

Part of: M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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Competence Certificate
Oral exam, about 25 minutes

Prerequisites
M-MACH-102562 - Materials Science must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-MACH-102562 - Materials Science must have been passed.

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

**Technology of steel components**
2174579, SS 2018, 2 SWS, Open in study portal

**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
V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005
3.217 Course: Theory of Stability [T-MACH-105372]

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

Part of: M-MACH-104442 - Schwerpunkt: Schwingungslehre

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Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory

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

Theory of Stability
2163113, SS 2018, 2 SWS, Open in study portal

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
### 3.218 Course: Thermal Solar Energy [T-MACH-105225]

**Responsible:** Prof. Dr. Robert Stieglitz  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik

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**Competence Certificate**  
Oral examination, 30 minutes

**Prerequisites**  
none

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

**Lecture (V)**  
**Thermal Solar Energy**  
2169472, WS 18/19, 2 SWS, Open in study portal

**Learning Content**  
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).
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
3.219 Course: Thermal Turbomachines I [T-MACH-105363]

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

**Part of:** M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

### Events

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### Competence Certificate

oral exam, duration 30 min.

### Prerequisites

none

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

#### Thermal Turbomachines I

2169453, WS 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)


Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993


**Thermal Turbomachines I (in English)**
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)


Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

3.220 Course: Thermal Turbomachines II [T-MACH-105364]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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Competence Certificate
oral exam, duration: 30 min.

Prerequisites
none

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

Thermal Turbomachines II
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)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Thermal Turbomachines II (in English)
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)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
3.221 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-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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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:

Learning Content

1. The role of the tires and wheels in a vehicle
2. Geometric of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology including Design and manufacturing methods, Wheeltesting
7. Tire pressure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Workload

regular attendance: 22.5 hours
self-study: 97.5 hours

Literature

Manuscript to the lecture
3.222 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-102812 - Schwerpunkt: Antriebssysteme

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**Exams**

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**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 knowledge in mathematics, mechanics and materials science

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

**Learning Content**

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running-in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Strieber 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
3.223 Course: Turbo Jet Engines [T-MACH-105366]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Exams**

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**Competence Certificate**
oral exam, duration: 20 min.

**Prerequisites**
none

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

**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  
3.224 Course: Tutorial Advanced Mathematics I [T-MATH-100525]

**Responsible:** PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102859 - Höhere Mathematik

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**Competence Certificate**

Learning assessment is carried out by written assignments (pre-requisite). Exact requirements will be communicated in the lectures.

**Prerequisites**

None.
3.225 Course: Tutorial Advanced Mathematics II [T-MATH-100526]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics
Part of: M-MATH-102859 - Höhere Mathematik

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Events

| SS 2018 | 0120020 | Advanced Mathematics II (Problem Session) | 2 SWS | Practice (Ü) | Thäter |
| SS 2018 | 0180900 | Übungen zu 0180800 | 2 SWS | Practice (Ü) | Arens |
| SS 2018 | 0181100 | Übungen zu 0181000 | 2 SWS | Practice (Ü) | Arens |

Exams

| SS 2018 | 7700024 | Problem Class for Advanced Mathematics II | Prüfung (PR) | Hettlich, Kirsch, Arens |

Competence Certificate

Learning assessment is carried out by written assignments (pre-requisite). Exact requirements will be communicated in the lectures.

Prerequisites

None.
3.226 Course: Tutorial Advanced Mathematics III [T-MATH-100527]

Responsible: PD Dr. Tilo Arens  
               Prof. Dr. Roland Griesmaier  
               PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102859 - Höhere Mathematik

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Competence Certificate
Learning assessment is carried out by written assignments (pre-requisite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102572 - Technische Mechanik

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**Exams**

| SS 2018 | Tutorial Engineering Mechanics I | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | Tutorial Engineering Mechanics I | Prüfung (PR) | Böhlke, Langhoff |
| WS 18/19 | Tutorial Engineering Mechanics I | Prüfung (PR) | Böhlke, Langhoff |

**Competence Certificate**

Attestations have to be achieved in the following four categories: mandatory written homework problems, written homework problems, computational homework problems, colloquia.

This course is passed if all mandatory written homework problems are passed and if in the other three categories (written homework problems, computational homework problems, colloquia) in total at most three attestations have been finally not passed, at most one in each of the three categories.

Successful participation in this course allows for registration to the Exam "Engineering Mechanics I" (see T-MACH-100282)

**Prerequisites**

None

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

**Tutorial Engineering Mechanics I**

2161246, WS 18/19, 2 SWS, Open in study portal  
Practice (Ü)

**Learning Content**

see lecture Engineering Mechanics I

**Workload**

time of attendance: 21h; self-study: 49h

**Literature**

see lecture Engineering Mechanics I
3.228 Course: Tutorial Engineering Mechanics II [T-MACH-100284]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-102572 - Technische Mechanik

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Exams

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Competence Certificate

Attestations have to be achieved in the following four categories: mandatory written homework problems, written homework problems, computational homework problems, colloquia.

This course is passed if all mandatory written homework problems are passed and if in the other three categories (written homework problems, computational homework problems, colloquia) in total at most two attestations have been finally not passed, at most one in each of the three categories.

Successful participation in this course allows for registration to the Exam "Engineering Mechanics II" (see T-MACH-100283)

Prerequisites
None

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

Tutorial Engineering Mechanics II
2162251, SS 2018, 2 SWS, Open in study portal

Learning Content
see lecture Engineering Mechanics II

Workload

time of attendance: 21h; self-study: 49h

Literature
see lecture Engineering Mechanics II

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

Part of: M-MACH-102572 - Technische Mechanik

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Competence Certificate
Attestations, successful accomplishment of exercise sheets

Prerequisites
None

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

Engineering Mechanics III (Tutorial)
2161204, WS 18/19, 2 SWS, Open in study portal

Learning Content
In the Tutorial exercises for the corresponding subjects of the lecture are presented. During the tutorial part of the tutorial exercises are presented and instructions for those exercises are given which have to be done as homework.

The homework is mandatory and is corrected by the tutors. A successful elaboration of the homework is necessary to take part in the final exam.

Workload
time of attendance: 21h; self-study: 39h

Literature
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006
Gross, Hauger, Schnell: Technische Mechanik Bd. 3, Heidelberg, 1983
Lehmann: Elemente der Mechanik III, Kinetik, Braunschweig, 1975
Göldner, Holzweissig: Leitfaden der Technischen Mechanik.
Hagedorn: Technische Mechanik III.
### 3.230 Course: Tutorial Engineering Mechanics IV [T-MACH-105203]

**Responsible:** Prof. Dr.-Ing. Wolfgang Seemann  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102572 - Technische Mechanik

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**Exams**
- SS 2018 | 76-T-MACH-105203 | Tutorial Engineering Mechanics IV | Prüfung (PR) | Seemann  
- WS 18/19 | 76-T-MACH-105203 | Tutorial Engineering Mechanics IV | Prüfung (PR) | Seemann

**Competence Certificate**  
Attestations, successful accomplishment of exercise sheets

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

**Engineering Mechanics IV (Tutorial)**  
2162232, SS 2018, 2 SWS, Open in study portal  
Practice (Ü)

**Learning Content**  
In the Tutorial exercises for the corresponding subjects of the lecture are presented. During the tutorial part of the exercises are presented and instructions are given for those exercises which have to be done as homework.

The homework is mandatory and is corrected by the tutors. A successful elaboration of the homework is necessary to take part in the final exam.

**Workload**  
time of attendance: 21h; self-study: 39h

**Literature**  
Hibbeler: Technische Mechanik 3, Dynamik, München, 2006  
Marguerre: Technische Mechanik III, Heidelberger Taschenbücher, 1968  
Magnus: Kreisel, Theorie und Anwendung, Springer-Verlag, Berlin, 1971  
Klotter: Technische Schwingungslehre, 1. Bd. Teil A, Heidelberg
### 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-102582 - Schwerpunkt: Kontinuumsmechanik  
- M-MACH-102746 - Wahlpflichtmodul

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#### Exams

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</table>

**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
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-102576 - Schlüsselqualifikationen

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<td>Der Wertstrom im Industrieunternehmen - Am Beispiel der Wertschöpfungskette bei Bosch</td>
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**Exams**

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<td>Value stream within enterprises – The value chain at Bosch</td>
<td>Prüfung (PR)</td>
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**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:*

**Der Wertstrom im Industrieunternehmen - Am Beispiel der Wertschöpfungskette bei Bosch**

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
3.233 Course: Vehicle Comfort and Acoustics I [T-MACH-105154]

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

Part of: M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik
        M-MACH-104442 - Schwerpunkt: Schwingungslehre

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<tr>
<td>Vehicle Comfort and Acoustics I</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Gauterin</td>
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Exams

| SS 2018       | 4       | Prüfung (PR)       | 1       |
| 76-T-MACH-105154 |         |                     |         |
| Vehicle Comfort and Acoustics I |         | Prüfung (PR) | Gauterin |
| WS 18/19      | 4       | Prüfung (PR)       | 1       |
| 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:

Vehicle Ride Comfort & Acoustics I
2114856, SS 2018, 2 SWS, Open in study portal

Lecture (V)

Learning Content
1. Perception of noise and vibrations
2. Fundamentals of acoustics and vibrations
3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations
4. The relevance of tire and 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
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

The script will be supplied in the lectures

Vehicle Comfort and Acoustics I
2113806, WS 18/19, 2 SWS, Open in study portal

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
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

The script will be supplied in the lectures
3.234 Course: Vehicle Comfort and Acoustics II [T-MACH-105155]

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

 Part of: M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik
 M-MACH-104442 - Schwerpunkt: Schwingungslehre

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<td>2114857</td>
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<td>Lecture (V)</td>
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Competence Certificate
Oral Examination
Duration: 30 up to 40 minutes
Auxiliary means: none

Prerequisites
Can not be combined with lecture T-MACH-102205

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

Vehicle Comfort and Acoustics II
2114825, SS 2018, 2 SWS, Open in study portal

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.

Vehicle Ride Comfort & Acoustics II
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.
3.235 Course: Vehicle Ergonomics [T-MACH-108374]

**Responsible:** Dr.-Ing. Tobias Heine  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102815 - Schwerpunkt: Entwicklung und Konstruktion  
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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<th>Vehicle Ergonomics</th>
<th>Prüfung (PR)</th>
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**Competence Certificate**

written exam, 60 minutes

**Prerequisites**

none

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

Part of: M-MACH-102638 - Schwerpunkt: Bahnsystemtechnik
M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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<td>Vehicle Lightweight Design - Strategies, Concepts, Materials</td>
<td>Prüfung (PR)</td>
<td>Henning</td>
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</table>

Competence Certificate
Written exam, 90 minutes

Prerequisites
none

Recommendation
none

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

Vehicle Lightweight design – Strategies, Concepts, Materials
2113102, WS 18/19, 2 SWS, Open in study portal

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
metallic materials
steal, aluminium, magnesium, titan

Workload
lectures: 21h, preparation of examination: 79h
### Course: Vehicle Mechatronics I [T-MACH-105156]

**Responsible:** Prof. Dr.-Ing. Dieter Ammon  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102818 - Schwerpunkt: Kraftfahrzeugtechnik

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<td>2113816</td>
<td>Vehicle Mechatronics I</td>
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<td>Lecture (V)</td>
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<td>Vehicle Mechatronics I</td>
<td>Prüfung (PR)</td>
<td>Ammon</td>
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</table>

**Competence Certificate**

Written examination  

Duration: 90 minutes  

Auxiliary means: none

**Prerequisites**  
none

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

### Vehicle Mechatronics I  
2113816, WS 18/19, 2 SWS, [Open in study portal](#)

**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 stabilizer bars  
Vehicle dynamics controls, driver assistance systems  
3. Modelling technology  
Mechanics - multi body dynamics  
Electrical and electronic 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. System design (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
5. Roddeck, W., Einführung in die Mechatronik, Teubner, Stuttgart, 1997
Course: Vibration Theory [T-MACH-105290]

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

Part of:
- M-MACH-102746 - Wahlpflichtmodul
- M-MACH-104442 - Schwerpunkt: Schwingungslehre

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<td>Practice (Ü)</td>
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<td>Fidlin, Leister</td>
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Exams
- SS 2018: 76-T-MACH-105290 Vibration Theory
- WS 18/19: 76-T-MACH-105290 Vibration Theory

Competence Certificate:
- written exam, 180 min.

Prerequisites:
- none

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

Vibration Theory
2161212, WS 18/19, 2 SWS, Open in study portal

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.
- 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
### 3.239 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

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

**Part of:** M-MACH-102746 - Wahlpflichtmodul

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**Events**

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<td>Ovtcharova</td>
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**Competence Certificate**

oral exam, 20 min.

**Prerequisites**

none
3.240 Course: Virtual Reality Practical Course [T-MACH-102149]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102583 - Schwerpunkt: Informationsmanagement  
M-MACH-102820 - Schwerpunkt: Mechatronik

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<td>Virtual Reality Practical Course</td>
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**Competition Certificate**
Assessment of another type (graded)

**Prerequisites**
None

**Annotation**
Number of participants is limited

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

**Virtual Reality Practical Course**
2123375, WS 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. Implementation and practice by developing a driving simulator in small groups.
3.241 Course: Vortex Dynamics [T-MACH-105784]

**Responsible:** Dr. Jochen Kriegseis  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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<td>Vortex Dynamics</td>
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<td>WS 18/19</td>
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**Competence Certificate**  
oral exam - 30 minutes

**Prerequisites**  
none

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

**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 vortex identification approaches

**Workload**
- reguläre attendance: 20h  
- Self-study: 100h

**Literature**
3.242 Course: Warehousing and Distribution Systems [T-MACH-105174]

**Responsible:** Prof. Dr.-Ing. Kai Furmans  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102821 - Schwerpunkt: Technische Logistik

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**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:**

**Warehousing and distribution systems**  
2118097, SS 2018, 2 SWS, [Open in study portal](#)

**Description**  
**Media:**  
presentations, black board

**Learning Content**  
- Introduction  
- Yard management  
- Receiving  
- Storage and picking  
- Workshop on cycle times  
- Consolidation 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

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

WISSEER, 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
3.243 Course: Wave and Quantum Physics [T-PHYS-108322]

Responsible: Prof. Dr. Gernot Goll
Prof. Dr. Bernd Pilawa

Organisation: KIT Department of Physics
Part of: M-PHYS-104030 - Physik

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<td>SS 2018 4040412</td>
<td>Übungen zu Wellen und Quantenphysik</td>
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<td>Prüfung (PR)</td>
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<td>WS 18/19 7800124</td>
<td>Wave and Quantum Physics (Exam in English)</td>
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Competence Certificate
Written exam (usually about 180 min)

Prerequisites
none
3 Course: Wave Propagation [T-MACH-105443]

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

Part of: M-MACH-104442 - Schwerpunkt: Schwingungslehre

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Events

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<td>2 SWS</td>
<td>Lecture (V)</td>
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Exams

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<td>Wave Propagation</td>
<td>Prüfung (PR)</td>
<td>Seemann</td>
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</table>

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.
3.245 Course: Welding Technology [T-MACH-105170]

**Responsible:** Dr. Majid Farajian  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102819 - Schwerpunkt: Materialwissenschaft und Werkstofftechnik

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</table>

**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:**

### 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).
Literatur
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.
**Course: Windpower [T-MACH-105234]**

**Responsible:** Dr. Norbert Lewald  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
M-MACH-102816 - Schwerpunkt: Grundlagen der Energietechnik  
M-MACH-102838 - Schwerpunkt: Kraft- und Arbeitsmaschinen

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**Events**

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**Exams**

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</table>

**Competence Certificate**

written exam, 120 minutes

**Prerequisites**

none

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

**Windpower**

2157381, WS 18/19, 2 SWS, Open in study portal

**Description**

**Media:**

A scriptum that has to be overhauled 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. Began 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.
3.247 Course: Working Methods in Mechanical Engineering [T-MACH-105296]

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

Part of: M-MACH-102576 - Schlüsselqualifikationen

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Events

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Exams

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<td>Working Techniques for Mechanical Engineering</td>
<td>Prüfung (PR)</td>
<td>Deml</td>
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</table>

Competence Certificate
Tests within the workshop sessions concerning the topics of the online-lecture as well as active participation during all four workshop sessions.

Prerequisites
none

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

Working Methods in Mechanical Engineering
2110969, SS 2018, 1 SWS, Open in study portal

Learning Content

1. Time- and self-management
2. Literature research
3. Team work
4. Scientific writing
5. Scientific presentation

Workload
The amount of work accounts for 60 h (=2 ECTS).

Literature
The script as well as further literature resources are available on ILIAS.
### 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-102816 - Schwerpunkt: Grundlagen der Energietechnik

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<td>SS 2018 2171488</td>
<td>Workshop on computer-based flow measurement techniques</td>
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<td>Practical course (P)</td>
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<td>Workshop on computer-based flow measurement techniques</td>
<td>3 SWS</td>
<td>Practical course (P)</td>
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**Exams**  
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<td>Bauer</td>
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</table>

### Competence Certificate
Group colloquia for each topic

- Duration: approximately 10 minutes
- no tools or reference materials may be used

### Prerequisites
none

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

**Workshop on computer-based flow measurement techniques**  
2171488, SS 2018, 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
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
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<td>Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau</td>
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Studien- und Prüfungsordnung
des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau

vom 04. August 2015


Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 KITG iVm. § 32 Absatz 3 Satz 1 LHG am 04. August 2015 erteilt.

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§ 24 Aberkennung des Bachelorgrades
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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 Bachelorprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Bachelorstudiengang Maschinenbau am KIT.

§ 2 Ziel des Studiums, Akademischer Grad
(1) Im Bachelorstudium sollen die wissenschaftlichen Grundlagen und die Methodenkompetenz der Fachwissenschaften vermittelt werden. Ziel des Studiums ist die Fähigkeit, einen konsekutiven Masterstudiengang erfolgreich absolvieren zu können sowie das erworbene Wissen berufsfeldbezogen anwenden zu können.
(2) Aufgrund der bestandenen Bachelorprüfung wird der akademische Grad „Bachelor of Science (B.Sc.)“ für den Bachelorstudiengang Maschinenbau verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte
(1) Der Studiengang nimmt teil am Programm „Studienmodelle individueller Geschwindigkeit“. Die Studierenden haben im Rahmen der dortigen Kapazitäten und Regelungen bis einschließlich drittem Fachsemester Zugang zu den Veranstaltungen des MINT-Kollegs Baden-Württemberg (im folgenden MINT-Kolleg).
(2) Die Regelstudienzeit beträgt sechs Semester. Bei einer qualifizierten Teilnahme am MINT-Kolleg bleiben bei der Anrechnung auf die Regelstudienzeit bis zu zwei Semester unberücksichtigt. Die konkrete Anzahl der Semester richtet sich nach § 8 Absatz 2 Satz 3 bis 5.
Eine qualifizierte Teilnahme liegt vor, wenn die Studierende Veranstaltungen des MINT-Kollegs für die Dauer von mindestens einem Semester im Umfang von mindestens zwei Fachkursen (Gesamtworkload 10 Semesterwochenstunden) belegt hat. Das MINT-Kolleg stellt hierüber eine Bescheinigung aus.
(6) Lehrveranstaltungen können nach vorheriger Ankündigung auch in englischer Sprache angeboten werden, sofern es deutscher Sprachpragmatik Wahlmöglichkeiten gibt.

§ 4 Modulprüfungen, Studien- und Prüfungsleistungen


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 lehrveranstaltungsbeigleitend erbracht werden. Die Bachelorprüfung 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 Bachelorarbeit ist im Modulhandbuch geregelt.


(3) Zu einer Erfolgskontrolle ist zuzulassen, wer

1. in den Bachelorstudiengang 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 Bachelorstudiengang 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.
§ 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. Ein 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. 5 zu beachten. 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 Einzelpprüfungen 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 Prüfungsleiters 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/prüfenden zuordnen ist. Die wesentlichen Gegenstände und Ergebnisse einer solchen 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/zur 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 der 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


(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 und fachliche Betreuung zu gewährleisten. 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.
Bei der Bildung der gewichteten Durchschnitt der Modulnoten, der Fachnoten und der Gesamtnote wird nur die erste Dezimalstelle hinter dem Komma berücksichtigt; alle weiteren Stellen werden ohne Rundung gestrichen.

Jedes Modul und jede Erfolgskontrolle darf in demselben Studiengang nur einmal gewertet werden.

Eine Prüfungsleistung ist bestanden, wenn die Note mindestens „ausreichend“ (4,0) ist.


Die Ergebnisse der Erfolgskontrollen sowie die erworbenen Leistungspunkte werden durch den Studierendendienst des KIT verwaltet.

Die Noten der Module eines Faches gehen in die Fachnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein.

Die Gesamtnote der Bachelorprüfung, die Fachnoten und die Modulnoten lauten:

<table>
<thead>
<tr>
<th>Wertung</th>
<th>Notenbereich</th>
</tr>
</thead>
<tbody>
<tr>
<td>sehr gut</td>
<td>bis 1,5</td>
</tr>
<tr>
<td>gut</td>
<td>von 1,6 bis 2,5</td>
</tr>
<tr>
<td>befriedigend</td>
<td>von 2,6 bis 3,5</td>
</tr>
<tr>
<td>ausreichend</td>
<td>von 3,6 bis 4,0</td>
</tr>
</tbody>
</table>

§ 8 Orientierungsprüfungen, Verlust des Prüfungsanspruchs

Die Teilmodulprüfungen Höhere Mathematik I, Technische Mechanik I, Technische Mechanik II in den Modulen Höhere Mathematik und Technische Mechanik sind bis zum Ende des Prüfungszeitraums des zweiten Fachsemesters abzulegen (Orientierungsprüfungen).

Wer die Orientierungsprüfungen einschließlich etwaiger Wiederholungen bis zum Ende des Prüfungszeitraums des dritten Fachsemesters nicht erfolgreich abgelegt hat, verliert den Prüfungsanspruch im Studiengang, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist; hierüber entscheidet der Prüfungsausschuss auf Antrag der oder des Studierenden. Eine zweite Wiederholung der Orientierungsprüfungen ist ausgeschlossen.

Die Fristüberschreitung hat die/der Studierende insbesondere dann nicht zu vertreten, wenn eine qualifizierte Teilnahme am MINT-Kolleg im Sinne von § 3 Abs. 2 vorliegt. Ohne ausdrückliche Genehmigung des Vorsitzenden des Prüfungsausschusses gilt eine Fristüberschreitung von

1. einem Semester als genehmigt, wenn die/der Studierende eine qualifizierte Teilnahme am MINT-Kolleg gemäß § 3 Abs. 2 im Umfang von einem Semester nachweist oder
2. zwei Semestern als genehmigt, wenn die/der Studierende eine qualifizierte Teilnahme am MINT-Kolleg gemäß § 3 Abs. 2 im Umfang von zwei Semestern nachweist.

Als Nachweis gilt die vom MINT-Kolleg gemäß § 3 Abs. 2 auszustellende Bescheinigung, die beim Studierendendienst des KIT einzureichen ist. Im Falle von Nr. 1 kann der Vorsitzende des Prüfungsausschusses auf Antrag der Studierenden die Frist um ein weiteres Semester verlängern, wenn dies aus studienorganisatorischen Gründen für das fristgerechte Ablegen der Orientierungsprüfung erforderlich ist, insbesondere weil die Module, die Bestandteil der Orientierungsprüfung sind, nur einmal jährlich angeboten werden.

Ist die Bachelorprüfung bis zum Ende des Prüfungszeitraums des neunten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch.

(4) Der Prüfungsanspruch geht auch verloren, wenn eine nach dieser Studien- und Prüfungsordnung erforderliche Studien- oder Prüfungsleistung endgültig nicht bestanden ist oder eine Wiederholungsprüfung nach § 9 Abs. 6 nicht rechtzeitig erbracht wurde, es sei denn die Fristüberschreitung ist nicht selbst zu vertreten.

§ 9 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.


(10) Die Wiederholung einer bestandenen Prüfungsleistung ist nicht zulässig.

§ 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.


(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 Bachelorarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, der/die Studierende hat die Fristüberschreitung nicht zu vertreten.


§ 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


(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
§ 13 Studierende mit Behinderung oder chronischer Erkrankung


(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 § 20 erforderlichen Studien- und Prüfungsleistungen zu erbringen, kann der Prüfungsausschuss auf Antrag der/des Studierenden, dass einzelne Studien- und Prüfungsleistungen nach Ablauf der in dieser Studien- und Prüfungsordnung vorgesehenen Fristen absolviert werden können.

§ 14 Modul Bachelorarbeit

(1) Voraussetzung für die Zulassung zum Modul Bachelorarbeit ist, dass die/der Studierende Modulprüfungen im Umfang von 120 LP erfolgreich abgelegt hat. Über Ausnahmen entscheidet der Prüfungsausschuss auf Antrag der/des Studierenden.


(3) Thema, Aufgabenstellung und Umfang der Bachelorarbeit sind von dem Betreuer bzw. der Betreuerin so zu begrenzen, dass sie mit dem in Absatz 4 festgelegten Arbeitsaufwand bearbeitet werden kann.


(5) Bei der Abgabe der Bachelorarbeit 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 Bachelorarbeit mit „nicht ausreichend“ (5,0) bewertet.


§ 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 Rahmen der Bewertung dieser beiden Personen die Note der Bachelorarbeit fest; er kann auch einen weiteren Gutachter bestellen. Die Bewertung hat innerhalb von sechs Wochen nach Abgabe der Bachelorarbeit zu erfolgen.

(2) Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.
§ 15 a Mastervorzug

§ 16 Überfachliche Qualifikationen
Neben der Vermittlung von fachlichen Qualifikationen ist der Auf- und Ausbau überfachlicher Qualifikationen im Umfang von mindestens 6 LP Bestandteil eines Bachelorstudiums. Überfachliche Qualifikationen können additiv oder integrativ vermittelt werden.

§ 17 Prüfungsausschüsse


(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/den Vorsitzende/n des Prüfungsausschusses.

(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.


§ 18 Prüfende und Beisitzende

(1) Der Prüfungsausschuss bestellt die Prüfenden. Er kann die Bestellung der/dem Vorsitzenden übertragen.

(2) Prüfende sind Hochschullehr/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, 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.

§ 19 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 Studiengang 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 Hochschul-
rektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpberauchung zu beachten.

(5) Außerhalb des Hochschulsystems erworbenen 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 wur-
den, 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 jeweilige Prüfungsausschuss. Im Rah-
men der Feststellung, ob ein wesentlicher Unterschied im Sinne des Absatz 1 vorliegt, sind die zuständigen Fachvertreter/innen zu hören. Der jeweilige Prüfungsausschuss entscheidet in Ab-
hängigkeit von Art und Umfang der anzurechnenden Studien- und Prüfungsleistungen über die Einstufung in ein höheres Fachsemester.

II. Bachelorprüfung

§ 20 Umfang und Art der Bachelorprüfung

(1) Die Bachelorprüfung besteht aus den Modulprüfungen nach Absatz 2 sowie dem Modul Ba-
chelorarbeit (§ 14).

(2) Es sind Modulprüfungen in folgenden Pflichtfächern abzulegen:

1. Ingenieurwissenschaftliche Grundlagen: Modul(e) im Umfang von 143 LP,
2. Vertiefung im Maschinenbau: Modul(e) im Umfang von 16 LP,
3. Überfachliche Qualifikationen im Umfang von 6 LP gemäß § 16.

Die Festlegung der zur Auswahl stehenden Module und deren Fachzuordnung werden im Mo-
dulhandbuch getroffen.

§ 21 Bestehen der Bachelorprüfung, Bildung der Gesamtnote

(1) Die Bachelorprüfung ist bestanden, wenn alle in § 20 genannten Modulprüfungen mindestens mit „ausreichend“ bewertet wurden.

(2) Die Gesamtnote der Bachelorprüfung errechnet sich als ein mit Leistungspunkten gewichte-
ter Notendurchschnitt der Fachnoten sowie des Moduls Bachelorarbeit.

Dabei wird die Note des Moduls Bachelorarbeit mit dem doppelten Gewicht gegenüber den Noten der übrigen Fächer berücksichtigt.

(3) Haben Studierende die Bachelorarbeit mit der Note 1,0 und die Bachelorprüfung mit einem Durchschnitt von 1,2 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung“ (with distinction) verliehen.

§ 22 Bachelorzeugnis, Bachelorurkunde, Diploma Supplement und Transcript of Records

(1) Über die Bachelorprüfung werden nach Bewertung der letzten Prüfungsleistung eine Ba-
chelorurkunde und ein Zeugnis erstellt. Die Ausfertigung von Bachelorurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen der letzten Prüfungsleistung erfolgen. Bachelorurkun-

(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.


III. Schlussbestimmungen

§ 23 Bescheinigung von Prüfungsleistungen

Haben Studierende die Bachelorprüfung 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.

§ 24 Aberkennung des Bachelorgrades

(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 Bachelorprüfung für „nicht bestanden“ erklärt werden.

(2) Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass 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 Bachelorprüfung 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 Bachelorurkunde einzuziehen, wenn die Bachelorprüfung aufgrund einer Täuschung für „nicht bestanden“ erklärt wurde.


(6) Die Aberkennung des akademischen Grades richtet sich nach § 36 Abs. 7 LHG.
§ 25 Einsicht in die Prüfungsakten
(1) Nach Abschluss der Bachelorprüfung wird den Studierenden auf Antrag innerhalb eines Jahres Einsicht in das Prüfungsexemplar ihrer Bachelorarbeit, 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.

§ 26 Inkrafttreten, Übergangsvorschriften
(1) Diese Studien- und Prüfungsordnung tritt am 01. Oktober 2016 in Kraft.

Karlsruhe, den 04. August 2015

*Professor Dr.-Ing. Holger Hanselka (Präsident)*
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vom 21. Februar 2019


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. § 9 Absatz 11 werden folgende Sätze 3 und 4 angefügt:

„Die Präsentation nach § 14 Absatz 1 a ist eine Studienleistung und kann bei einer Bewertung mit „nicht bestanden (not passed)” (im Gegensatz zu anderen Studienleistungen) nur einmal wiederholt werden. Die Präsentation ist endgültig nicht bestanden, wenn sie zweimal mit „nicht bestanden” (not passed) bewertet wurde.”

2. § 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

3. § 14 wird wie folgt geändert:


b) 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.

c) 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.
4. § 17 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.

5. § 18 Absatz 3 wird wie folgt geändert:
   Nach dem Wort „sofern“ werden die Wörter „die KIT-Fakultät eine Prüfungsbefugnis erteilt hat und“ gestrichen.

6. § 26 Absatz 5 wird aufgehoben und folgender neuer Absatz 5 eingefügt:
   „(5) Für Studierende, die
   1. ihr Studium im Bachelorstudiengang Maschinenbau vor dem Wintersemester 2018/2019 aufgenommen haben oder
   2. ihr Studium im Bachelorstudiengang Maschinenbau ab dem Wintersemester 2018/2019 in einem höheren Fachsemester aufgenommen haben bzw. aufnehmen sofern das Fachsemester über dem Jahrgang der Studienanfänger zum Wintersemester 2018/2019 liegt,
   finden § 9 Abs. 11 und § 14 Abs. 1 a in der Fassung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau vom 04. August 2015 (Amtliche Bekanntmachung des KIT Nr. 62 vom 06. August 2015) weiterhin Anwendung.

   Studierende nach Satz 1 Ziffer 1 und Ziffer 2, können das Modul Bachelorarbeit auf Grundlage der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Bachelorstudiengang Maschinenbau in der Fassung vom 04. August 2015 (Amtliche Bekanntmachung des KIT Nr. 62 vom 06. August 2015) letztmalig bis zum 31. März 2023 ablegen“

Artikel 2 – Inkrafttreten

Diese Änderungssatzung tritt zum 01. April 2019 in Kraft.

Karlsruhe, den 21. Februar 2019

gez. Prof. Dr.-Ing. Holger Hanselka
(Präsidium)