Module Handbook
Mechanical Engineering International (B.Sc.)
SPO 2017
Valid from Summer Term 2019
Date: 18.03.2019
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## 1 Field of study structure

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### 1.4 Majors in Mechanical Engineering (International)

Election block: Majors in Mechanical Engineering (International) (1 item)

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### Summer Term 2019

#### B.Sc. Mechanical Engineering International: Basic Courses, 1st year

<table>
<thead>
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<tr>
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<td>3174015 Materials Science and Engineering II (Lecture)</td>
<td>3162015 Engineering Mechanics II (Lecture)</td>
<td>3162016 Engineering Mechanics II (Lecture)</td>
<td>3166526 Technical Thermodynamics and Heat Transfer II (Lecture and Tutorials)</td>
<td>3146018 Mechanical Design II (Tutorials)</td>
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<td>09:45 am</td>
<td>3120005 Advanced Mathematics II (Lecture)</td>
<td>3120050 Advanced Mathematics II (Problem Session)</td>
<td>3146016 Materials Science and Engineering Lab Course</td>
<td>3162286 Lab Course 'Engineering Mechanics II'</td>
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<td>11:30 am</td>
<td>3162016 Engineering Mechanics II (Lecture)</td>
<td>3162017 Mechanical Design II (Lecture)</td>
<td>3146017 Computer Science for Engineers Lab Course</td>
<td>3146020 Mechanical Design IV Workshop</td>
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<td>01:00 pm</td>
<td>3121036 Computer Science for Engineers (Tutorial)</td>
<td>3154510 Fluid Mechanics I (Tutorials)</td>
<td>3162012 Engineering Mechanics 4 (Tutorials)</td>
<td>3134140 Machines and Processes (Auditorium exercises)</td>
<td>10.91 room 203</td>
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<tr>
<td>03:45 pm</td>
<td>3146032 Wave and Quantum Physics (Tutorial)</td>
<td>3162013 Engineering Mechanics 4 (Tutorial)</td>
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<td>3146022 Workshop</td>
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<td>06:30 pm</td>
<td>3110999 Technische Mechanik III (Maschinenbau) (English)</td>
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<td>3160432 Wave and Quantum Physics (Auditorium exercises)</td>
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#### Summer Term 2019

#### B.Sc. Mechanical Engineering International: 2nd year

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<td>3166526 Technical Thermodynamics and Heat Transfer II</td>
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<td>3156030 Technical Thermodynamics and Heat Transfer II (Auditorium exercises)</td>
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<td>3134146 Engineering Mechanics 4 (Tutorials)</td>
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#### Basic Courses | Lecture | Tutorial | Lab Course

#### Tutorial

01/03/2019

#### Lab Course

04/03/2019

#### Workshop
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<td>3190923 Fundamentals of Energy Technology</td>
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<td>02:00 pm - 03:30 pm</td>
<td>2114865 Automotive Engineering II</td>
<td>2114866 Vehicle Ride Comfort &amp; Acoustics I</td>
<td>2114868 Vehicle Ride Comfort &amp; Acoustics II</td>
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<td>3134140 Machines and Processes</td>
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**Lecture**

| Block course, time and location will be announced on the website | Block course, time and location will be announced on the website | Block course, time and location will be announced on the website | Block course, time and location will be announced on the website | Block course, time and location will be announced on the website |

**Module Handbook as of 18.03.2019**

Mechanical Engineering International (B.Sc.)
3 Modules

3.1 Module: Advanced Mathematics [M-MATH-104022]

Responsible: Prof. Dr. Maria Aksenovich
Dr. Stefan Kühnlein

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

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Competence Certificate
Three written exams for the parts I-III of length 120 minutes each.

Competence Goal
The students know the foundations of calculus of one and several variables, linear algebra, theory of differential equations, and probability theory. They know and can apply techniques in these fields.

Module grade calculation
The grade for the module is composed from equally weighted grades for the examinations in Advanced Mathematics I-III.

Prerequisites
None.

Content
Basic set theoretic notions, proofs, sequences and convergence, functions and continuity, series, derivatives, integrals, vector spaces, matrices, Laplace transform, functions of several variables, applications of multivariate calculus, Fourier analysis, differential equations, probability.

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

Literature
- Lecture notes
### 3.2 Module: Bachelor Thesis [M-MACH-103722]

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

**Part of:** Bachelor Thesis

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#### 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's 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).

#### Modelled conditions

The following conditions have to be fulfilled:

1. You need to earn at least 120 credits in the following fields:
   - Fundamentals of Engineering
   - International Project Management and Soft Skills
   - Majors in Mechanical Engineering (International)

#### 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: 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

Mandatory

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T-MACH-105205 Computer Science for Engineers 6 CR Ovtcharova
T-MACH-105206 Computer Science for Engineers 0 CR Ovtcharova

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
3.4 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

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

**Prerequisites**
none

**Annotation**
Exam and Lecture will be held in English.
3.5 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>7 CR</td>
<td>Böhlke, Langhoff</td>
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<td>T-MACH-100283</td>
<td>Engineering Mechanics II</td>
<td>6 CR</td>
<td>Böhlke, Langhoff</td>
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<td>T-MACH-105201</td>
<td>Engineering Mechanics III &amp; IV</td>
<td>10 CR</td>
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<td>T-MACH-100528</td>
<td>Tutorial Engineering Mechanics I</td>
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<td>T-MACH-100284</td>
<td>Tutorial Engineering Mechanics II</td>
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<td>T-MACH-105202</td>
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<td>T-MACH-105203</td>
<td>Tutorial Engineering Mechanics IV</td>
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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 theors 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, colloquiu, consultation hours (optional)
3.6 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

Credits: 8
Duration: 2 term
Language: Deutsch/Englisch
Level: 3
Version: 1

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 hours
self-study: 176 hours

Learning type
Lectures + tutorials

Literature
Zülpich, 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
3.7 Module: International Project Management and Soft Skills [M-MACH-103322]

**Responsible:** Prof. Dr.-Ing. Barbara Deml  
Prof. Dr. Stefan Nickel

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** International Project Management and Soft Skills

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<td>T-MACH-105296</td>
<td>Working Methods in Mechanical Engineering</td>
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<td>T-WIWI-108295</td>
<td>Project and Operations Management</td>
<td>2 CR</td>
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**Competence Certificate**
Success is monitored within the framework of academic achievements.

**Competence Goal**

- The student gains knowledge of the principles and various instruments of project management and project planning and the acquisition of abilities to plan projects and create controlling systems.
- The student performs an analysis of various methods and procedures of multi-project management and project controlling in a global context.
- The student acquires knowledge of the product development process as well as important parameters of product development and development methods in the context of project management.

**Prerequisites**

None

**Content**

*Working Methods in Mechanical Engineering:*

1. Time and self management  
2. Teamwork  
3. Literature research  
4. Scientific Writing  
5. Scientific Presentation

*Project and Operations Management:*

Students will learn how to structure planning problems occurring in a company’s operations or in international projects. Moreover, they are introduced to fundamental quantitative planning techniques and tools for solving real-world project and operations management problems.

Topics of the lecture include:

- Introduction to optimization  
- Network planning techniques (CPM, PERT, stochastic time analysis etc.)  
- Inventory management (single- and multi-period models etc.)  
- Operations scheduling (single and parallel machine scheduling etc.)

**Workload**

The total workload for this module is approximately 180 hours. The total workload per course is obtained from the workload contributing to lecture and exercise attendance, exam hours, and the required time which it takes for an average student with average capacities to achieve the specified learning targets of this module.

**Learning type**

Lectures  
Workshops

**Literature**

The script and references are available for download on ILIAS.
### 3.8 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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**Mandatory**

| T-MACH-105208 | Machines and Processes | 7 CR | Bauer, Kubach, Maas, Pritz |
| T-MACH-105232 | Machines and Processes, Prerequisite | 0 CR | Bauer, Kubach, Maas, Pritz |

**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
Module: Manufacturing Processes (MEI) [M-MACH-104232]

### 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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<td>Basics of Manufacturing Technology (MEI)</td>
<td>4 CR</td>
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### 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
3.10 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

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<td>Materials Science Lab Course</td>
<td>3 CR</td>
<td>Heilmaier, Möslang, Weidenmann</td>
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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

**WK II**

- Mechanical Testing
- Iron based alloys
- Non-iron based alloys
- Ceramics
- Glasses
- 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.
3.11 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
3.12 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

**Credits:** 20  
**Language:** Deutsch/Englisch  
**Level:** 3  
**Version:** 2

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<td>Mechanical Design I &amp; II</td>
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<td>Albers, Burkardt, Matthiesen</td>
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<tr>
<td>T-MACH-104810</td>
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<td>Mechanical Design III, Constructing the Team</td>
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<td>Albers, Matthiesen</td>
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<tr>
<td>T-MACH-105285</td>
<td>Mechanical Design IV, Constructing the Team</td>
<td>0 CR</td>
<td>Albers, Matthiesen</td>
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</table>

**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 elasto-statics 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 Development
  - 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
- Sealing
- 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 gearboxes
- 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 tooth shape
- Cycloid as flank curve
- Involute as flank curve
- Method of manufacturing gears
- Profil overlap
- Profil offset
- Limits of application and damage
• Dimensioning
• Tension 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
MKL1:
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

MKL2:
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
3 MODULES  Module: MF A: Global Production Management [M-MACH-103351]

3.13 Module: MF A: Global Production Management [M-MACH-103351]

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

Part of: Majors in Mechanical Engineering (International)

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<td>T-MACH-106731</td>
<td>Global Production Engineering (MEI)</td>
<td>4 CR</td>
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<tr>
<td>T-MACH-105379</td>
<td>Global Logistics</td>
<td>4 CR</td>
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Election block: SP A: Globales Produktionsmanagement (at least 8 credits)

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<td>T-MACH-105381</td>
<td>Virtual Engineering (Specific Topics)</td>
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<td>T-MACH-106732</td>
<td>Automated Production Systems (MEI)</td>
<td>4 CR</td>
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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

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.

After completion 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 aim of "SP A: Global Production Management" is to present the challenges of globally operating companies and to give an overview of the central aspects of global production networks as well as to gain in-depth knowledge of common methods and procedures for designing them. For this purpose, methods for site selection, approaches for the site-specific adaptation of production technologies as well as planning approaches for setting up a new production location will be imparted during the module. The module will be rounded off by presenting Industry 4.0 methods and technologies.

The topics in detail are:

- Framework conditions and influencing factors of global production (historical development, goals, opportunities and risks)
- Site selection
- Site-specific production adaptation
- Planning a new production site
- Design and management of global production networks
- Integration of Industry 4.0 methods and technologies

Recommendation

none

Workload

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

Learning type

Lectures, seminars, workshops, excursions
Module: MF B: Energy Engineering [M-MACH-103350]

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

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T-MACH-105220 Fundamentals of Energy Technology 8 CR Badea, Cheng

Election block: SP B: Energietechnik (at least 8 credits)

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T-MACH-105213 Fundamentals of Combustion I 4 CR Maas, Sommerer
T-MACH-105292 Heat and Mass Transfer 4 CR Bockhorn, Maas

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

Competence Goal
After completion of SP B students are able

- to describe the elements of an energy system and their 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 its effects on the energy system,
- to assess the technical boundary conditions of energy systems
- 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 renewables,
- to name the physical and chemical processes during energy conversion

Prerequisites
None

Content
The aim of SP B “Energy Engineering” is to bring the students closer to the challenges of modern energy systems. The functional principles of conventional and regenerative power plant types are presented and the underlying physical principles of technical combustion and heat and mass transfer are explained. The students learn the basics to evaluate energy systems on a technical and economic basis.

Topics include:

- forms of energy
- energy sources: fossil fuels, nuclear energy, renewable energies
- energy demand structures
- principles of thermal and electrical power plants (conventional and renewable)
- physical basics of technical combustion
- stationary and transient heat and mass transfer phenomena
- environmental aspects of energy production
- role of renewable energies
- conversion, transport and storage of energy
- economic feasibility study of energy systems
- future of the energy sector

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

Learning type
Lectures
Tutorials
Module: MF C: Automotive Engineering [M-MACH-103349]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering
Part of: Majors in Mechanical Engineering (International)

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<td>T-MACH-100092</td>
<td>Automotive Engineering I</td>
<td>8 CR Gauterin, Unrau</td>
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Election block: SP C: Kraftfahrzeugtechnik (at least 8 credits)

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<tr>
<td>T-MACH-102117</td>
<td>Automotive Engineering II</td>
<td>4 CR Gauterin, Unrau</td>
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<tr>
<td>T-MACH-105154</td>
<td>Vehicle Comfort and Acoustics I</td>
<td>4 CR Gauterin</td>
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<td>T-MACH-105155</td>
<td>Vehicle Comfort and Acoustics II</td>
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<tr>
<td>T-MACH-105210</td>
<td>Machine Dynamics</td>
<td>5 CR Proppe</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

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

Further learning objectives according to the selected courses of supplementary subjects.

Prerequisites

none

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. Transmissions: 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

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

Learning type

Lectures
Tutorials
### 3.16 Module: Orientation Exam [M-MACH-104162]

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

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<td>T-MACH-100282</td>
<td>Engineering Mechanics I</td>
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<td>T-MACH-100283</td>
<td>Engineering Mechanics II</td>
<td>6 CR</td>
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<td>T-MATH-108266</td>
<td>Advanced Mathematics I</td>
<td>7 CR</td>
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<td>Aksenovich, Kühnlein</td>
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**Modelled deadline**

This module must be passed until the end of the 3. term.
**M 3.17 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>
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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 the 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]

M

3.18 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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<td>Production Operations Management</td>
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<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)
Module: Technical Thermodynamics (BSc-Modul 05, TTD) [M-MACH-102574]

Purpose: To provide students with the competency to master the fundamentals of thermodynamics and the ability to apply the knowledge an problem-solving in various branches of mechanical engineering.

Responsibility: Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: Fundamentals of Engineering

Credits: 15
Duration: 2 term
Language: Deutsch/Englisch
Level: 3
Version: 1

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Competence Certificate
Prerequisite: atestation 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
4 Courses

4.1 Course: Advanced Mathematics I [T-MATH-108266]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Prof. Dr. Maria Aksenovich</th>
</tr>
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<tbody>
<tr>
<td>Dr. Stefan Kühnlein</td>
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**Competence Certificate**
Assessment is carried out in form of a written examinations of 120 minutes length.

**Prerequisites**
Passing scores for homework and the midterm test are prerequisites for the examination.

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

1. The course T-MATH-108265 - Advanced Mathematics I Prerequisite must have been passed.
4.2 Course: Advanced Mathematics I Prerequisite [T-MATH-108265]

**Responsible:** Prof. Dr. Maria Aksenovich  
Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-104022 - Höhere Mathematik

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**Competence Certificate**
Assessment is carried out based on written homework assignments and a midterm test. Exact requirements will be detailed in class.

**Prerequisites**
None.
4.3 Course: Advanced Mathematics II [T-MATH-108268]

**Responsible:** Prof. Dr. Maria Aksenovich  
Dr. Stefan Kühnlein  

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-104022 - Höhere Mathematik

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**Competence Certificate**  
Assessment is carried out in form of a written examinations of 120 minutes length.

**Prerequisites**  
Passing scores for homework and the midterm test are prerequisites for the examination.

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

1. The course T-MATH-108267 - Advanced Mathematics II Prerequisite must have been passed.
4.4 Course: Advanced Mathematics II Prerequisite [T-MATH-108267]

**Responsible:** Prof. Dr. Maria Aksenovich  
Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104022 - Höhere Mathematik

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**Competence Certificate**
Assessment is carried out based on written homework assignments and a midterm test. Exact requirements will be detailed in class.

**Prerequisites**
None.
4.5 Course: Advanced Mathematics III [T-MATH-108270]

**Responsible:** Prof. Dr. Maria Aksenovich  
Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104022 - Höhere Mathematik

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**Competence Certificate**
Assessment is carried out in form of a written examinations of 120 minutes length.

**Prerequisites**
Passing scores for homework and the midterm test are prerequisites for the examination.

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

1. The course T-MATH-108269 - Advanced Mathematics III Prerequisite must have been passed.
### 4.6 Course: Advanced Mathematics III Prerequisite [T-MATH-108269]

**Responsible:** Prof. Dr. Maria Aksenovich  
Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104022 - Höhere Mathematik

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**Assessment Certificate**  
Assessment is carried out based on written homework assignments and a midterm test. Exact requirements will be detailed in class.

**Prerequisites**  
None.
4.7 Course: Automated Production Systems (MEI) [T-MACH-106732]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-103351 - SP A: Globales Produktionsmanagement

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

**Prerequisites**  
none

*Below you will find excerpts from events regarding this course:*

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

**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.
4.8 Course: Automotive Engineering I [T-MACH-100092]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103349 - SP C: Kraftfahrzeugtechnik

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Exams

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<td>Automotive Engineering</td>
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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 regarding 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

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


4.9 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-103349 - SP C: Kraftfahrzeugtechnik

<table>
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Competence Certificate  
Written Examination  
Duration: 90 minutes  
Auxiliary means: none  
Prerequisites  
none

Below you will find excerpts from events regarding 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"
4.10 Course: Bachelor Thesis [T-MACH-108685]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-103722 - Bachelorarbeit

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</table>

**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 workload 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
   - International Project Management and Soft Skills
   - Majors in Mechanical Engineering (International)

**Annotation**

The workload for the preparation of the bachelor thesis is about 360 hours.
4.11 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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Exams

| SS 2018   | 76-T-MACH-104745 Basis of Measurement and Control Systems | Prüfung (PR) | Stiller |
| WS 18/19  | 76-T-MACH-104745 Basis of Measurement and Control Systems | Prüfung (PR) | Stiller |

Competence Certificate
written exam
2.5 hours

Prerequisites
none

Below you will find excerpts from events regarding this course:

Measurement and Control Systems
2137301, WS 18/19, 3 SWS, Open in study portal

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

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Learning Content

1. Dynamic systems
   - Properties of important systems and modeling
   - Transfer characteristics and stability
   - Controller design
   - Fundamentals of measurement
   - Estimation
   - Sensors
   - 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
### 4.12 Course: Basics of Manufacturing Technology (MEI) [T-MACH-108747]

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

**Organisation:** KIT Department of Mechanical Engineering

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**Part of:** M-MACH-104232 - Fertigungsprozesse (MEI)

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**Competence Certificate**

written exam (duration: 60 min)

**Prerequisites**

none

Below you will find excerpts from events regarding this course:

**Basics of Manufacturing Technology (MEI)**

3118092, 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/).

**Notes**

The lecture notes and further information on organisation of the lecture will be available on ILIAS.

**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

**Annotation**

None

**Workload**

regular attendance: 21 hours  
self-study: 99 hours

**Literature**

Lecture Notes
4.13 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 regarding 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
4.14 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.

Below you will find excerpts from events regarding this course:

**Computer Science for Engineers**

2121390, SS 2018, 4 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning 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.

**Workload**

Regular attendance: 21 hours

Self-study: 134 hours
Exercises Computer Science for Engineers
2121391, SS 2018, 2 SWS, Open in study portal

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
4.15 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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Competence Certificate
Written exam, duration 3 hours.

Prerequisites
none

Annotation
Exam will be held in english language.
4.16 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-104162 - Orientierungsprüfung

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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 regarding 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


**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-104162 - Orientierungsprüfung

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**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 regarding this course:**

**Engineering Mechanics II**

2162250, SS 2018, 3 SWS, [Open in study portal](#)

**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
4.18 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 regarding 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'Almembert, 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.
4 COURSES

Course: Exercises in Technical Thermodynamics and Heat Transfer I [T-MACH-105204]

**4.19 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.
Course: Exercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102574 - Technische Thermodynamik

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**Competence Certificate**

Homework is mandatory.

**Prerequisites**

none

Below you will find excerpts from events regarding 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


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

**Responsibility:** Prof. Dr.-Ing. Bettina Frohnapfel

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102565 - Strömungslehre

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**Exams**

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**Competence Certificate**

written exam 3 hours

**Prerequisites**

none

Below you will find excerpts from events regarding this course:

**Fluid Mechanics I**

2154512, SS 2018, 3 SWS, Open in study portal

**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**

3154510, SS 2018, 3 SWS, Open in study portal
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
4.22 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-103350 - SP B: Energietechnik

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Competence Certificate
Written exam, 3 h

Prerequisites
none

Below you will find excerpts from events regarding this course:

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

Description
Media:
Blackboard and Powerpoint presentation

Learning Content

- Ignition processes
- Fundamental concepts ans phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames

Annotation
Compulsory elective subject: 2+1 SWS and 5 LP.

Workload
Regular attendance: 22.5 h
Self-study: 97.5 h
Literature
Lecture notes,

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

Practice (Ü)

Literature
- Lecture Notes
4.23 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-103350 - SP B: Energietechnik

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<td>Badea, Cheng</td>
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</table>

Competence Certificate  
Written examination, 90 min

Prerequisites  
none

Below you will find excerpts from events regarding 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

Fundamentals of Energy Technology  
3190923, SS 2018, 3 SWS, Open in study portal
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
4.24 Course: Global Logistics [T-MACH-105379]

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

Part of: M-MACH-103351 - SP A: Globales Produktionsmanagement

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Exams

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Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events regarding 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,
4 COURSES

4.25 Course: Global Production Engineering (MEI) [T-MACH-106731]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-103351 - SP A: Globales Produktionsmanagement

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**Events**

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<td>Lanza</td>
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**Competence Certificate**

oral exam (45 min group examination with 3 students)

**Prerequisites**

none

*Below you will find excerpts from events regarding 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
4.26 Course: Heat and Mass Transfer [T-MACH-105292]

Responsibility: Prof. Dr.-Ing. Henning Bockhorn
Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103350 - SP B: Energietechnik

Type: Prüfungsleistung schriftlich
Credits: 4
Recurrence: Each term
Version: 1

Events

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Exams

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Competence Certificate

Written exam, 3 h

Prerequisites

none

Below you will find excerpts from events regarding this course:

Heat and mass transfer

2165512, WS 18/19, 2 SWS, Open in study portal

Learning Content

- Steady state and non-steady heat transfer in homogenous and compound materials; Plates, pipe sections and speriical 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"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung". Springer Verlag, 1993
4.27 Course: Machine Dynamics [T-MACH-105210]

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

Part of: M-MACH-103349 - SP C: Kraftfahrzeugtechnik

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Competence Certificate
written exam, 180 min.

Prerequisites
none

Below you will find excerpts from events regarding this course:

Machine Dynamics
2161224, SS 2018, 2 SWS, Open in study portal

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

Learning Content
Excercises related to the lecture
4.28 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 regarding this course:**

**Machines and Processes**
2185000, WS 18/19, 4 SWS, [Open in study portal](#)

**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
Course: Machines and Processes, Prerequisite [T-MACH-105232]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Dr.-Ing. Heiko Kubach  
Prof. Dr. Ulrich Maas  
Dr. Balazs Pritz

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102566 - Maschinen und Prozesse

**Type Studienleistung | Credits | Recurrence | Version**
--- | --- | --- | ---
Practical course (P) | 0 | Each term | 1

**Events**

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**Exam**

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<td>76-T-MACH-105232</td>
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</table>

**Competence Certificate**
successful completed training course

**Prerequisites**
none

Below you will find excerpts from events regarding this course:

**Machinery and Processes**
2187000, SS 2018, 1 SWS, Open in study portal

**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 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
4.30 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

**Part of:** M-MACH-102562 - Werkstoffkunde

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<tr>
<td>SS 2018 2174560 Materials Science and Engineering II for mach, phys</td>
<td>11</td>
<td>Each winter term</td>
<td>Prüfungsleistung mündlich</td>
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<td>11</td>
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**Exams**

| SS 2018 76-T-MACH-105145 Materials Science I, II | Prüfung (PR) | Heilmaier |
| SS 2018 76-T-MACH-105145-2 Materials Science I, II | Prüfung (PR) | Heilmaier |
| SS 2018 76-T-MACH-105145-English Materials Science I & II | Prüfung (PR) | Heilmaier |
| SS 2018 76-T-MACH-105145-W Materials Science I & II | Prüfung (PR) | Heilmaier |
| WS 18/19 76-T-MACH-105145 Materials Science I, II | Prüfung (PR) | Heilmaier |

**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 regarding this course:

**Materials Science and Engineering II for mach, phys**

2174560, SS 2018, 3 SWS, Open in study portal
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

Materials Science and Engineering I for mach, phys
2173550, WS 18/19, 4 SWS, Open in study portal

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
4.31 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** | **Credits** | **Recurrence** | **Version**
---|---|---|---
Studienleistung praktisch | 3 | Each summer term | 1

**Events**

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<td>2174597</td>
<td>Experimental Lab Course in Material Science</td>
<td>Practical course (P)</td>
<td>3 SWS</td>
<td>Gibmeier, Weidenmann, Lang, Heilmaier, Dietrich</td>
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<td>SS 2018</td>
<td>3174016</td>
<td>Materials Science and Engineering Lab Course</td>
<td>Practical course (P)</td>
<td>3 SWS</td>
<td>Gibmeier, Weidenmann, Lang, Heilmaier, Dietrich</td>
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**Exams**

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<td>Materials Science, Lab Course</td>
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<td>Materials Science and Engineering, Lab Course</td>
<td>Prüfung (PR)</td>
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</table>

**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 regarding 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
**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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<td>WS 18/19 2145178</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
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<td>WS 18/19 3145186</td>
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<td>Lecture (V)</td>
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**Exams**

| SS 2018 76-T-MACH-105286    | Prüfung (PR) | Albers, Burkardt  |
| WS 18/19 76T-MACH-105286    | Prüfung (PR) | Albers, Burkardt  |

**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 regarding this course:

**Mechanical Design II**
2146178, SS 2018, 2 SWS, Open in study portal

**Description**
**Media:**
Beamer  
Visualizer
Mechanical components

**Learning Content**
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;
Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

V 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

Concomitant 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)"
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 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
4.33 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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</table>

**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 regarding 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, system 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)

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)
4.34 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

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**Events**

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**Exams**

| SS 2018 | Practice (PR) | Each summer term | 1 |
| WS 18/19 | Practice (PR) | Each summer term | 1 |

**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 regarding this course:

### Tutorials Mechanical Design II

<table>
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<td>Practice (Ü)</td>
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**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 Maschinen ELEMENTEN;

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)
4.35 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>
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**Exams**

| SS 2018 | 76-T-MACH-104810    | Mechanical Design III & IV | Prüfung (PR) | Albers, Burkardt |
| WS 18/19 | 76-T-MACH-104810 | Mechanical Design III & IV | Prüfung (PR) | Albers, Burkardt |

**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 regarding 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 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)
Description
Media:
Beamer
Visualizer
Mechanical components

Learning Content
component connection
Tolerances and fittings
gears

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

CAD:
Pro/Engineer Tipps und Techniken, Wolfgang Berg, Hanser Verlag, ISBN: 3-446-22711-3(für Fortgeschrittene)
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)
4.36 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 regarding this course:

**Tutorials Mechanical Design III**

2145153, WS 18/19, 2 SWS, [Open in study portal](#)
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 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)

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**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
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)

Mechanical Design III (Workshop)
3145018, WS 18/19, 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.

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)
4.37 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 regarding this course:

**Tutorials Mechanical Design IV**

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**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)
4.38 Course: Presentation [T-MACH-108684]

Responsibility: Prof. Dr.-Ing. Martin Heilmayer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-103722 - Bachelorarbeit

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Exams
- WS 18/19 76-T-MACH-108684 Presentation Prüfung (PR)

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-108685 - Bachelor Thesis must have been started.

Annotation
The workload for the presentation of the bachelor thesis is about 90 hours.
**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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**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 regarding this course:

**Production Operations Management**

2110085, SS 2018, 4 SWS, [Open in study portal](https://ilias.studium.kit.edu/)

**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
Production Operations Management
2110085, WS 18/19, 2 SWS, Open in study portal

**Description**

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**

4.40 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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<td>Production Operations Management-Project</td>
<td>1 SWS</td>
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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 regarding 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
4.41 Course: Project and Operations Management [T-WIWI-108295]

Responsible: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-MACH-103322 - Internationales Projektmanagement und Überfachliche Qualifikationen

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Competence Certificate

Ungraded, the valuation is composed of:

- 50% written exam
- 25% workshop
- 25% case study

Prerequisites

None

Annotation

Description:

Operations management (OM) describes the process of planning and controlling the resources needed to produce a company’s products or services. While OM focuses on ongoing operations, project management (PM) is concerned with planning and controlling a set of activities with a defined start and end state. The objective of the first part (PM) of the course is to acquaint students with quantitative planning methods to analyze the network structure of large projects, i.e., to identify “critical” project activities, interdependencies between them, and their impact on key performance indicators (e.g., time and cost).

In the second part (OM) of the lecture, two major operational issues are discussed, inventory management and operations scheduling. Students will learn about basic decisions arising in inventory management and operations scheduling, and typical constraints (such as demand or capacity constraints) which have to be taken into account. Throughout the course, students will be given the opportunity to gain practical problem solving skills in short cases and exercises. They will be taught how to use modeling languages in combination with current software tools in order to implement and solve real-world mixed-integer programming models.

Content:

Students will learn how to structure planning problems occurring in a company’s operations or in international projects. Moreover, they are introduced to fundamental quantitative planning techniques and tools for solving real-world project and operations management problems.

Topics of the lecture include:

- Introduction to optimization
- Network planning techniques (CPM, PERT, stochastic time analysis etc.)
- Inventory management (single- and multi-period models etc.)
- Operations scheduling (single and parallel machine scheduling etc.)

Learning Targets:

Participants are capable of

- Formulating basic optimization problems frequently occurring in project and operations management contexts (including linear and integer programming, dynamic programming).
- Systematically examining the network structure of large projects (including identification of relationships between project activities, analysis of time-critical activities, computing expected project duration and costs etc.).
- Distinguishing between the different types and uses of inventory as well as the relevant costs associated with inventory.
- Recognizing the fundamental trade-offs in inventory management.
- Calculating order quantities in case of constant and time-varying demand.
- Classifying various kinds of scheduling problems in short-term production planning
- Sequencing jobs based on priority rules
- Developing schedules for single, parallel, and multiple machines.
4.42 Course: SmartFactory@Industry (MEI) [T-MACH-106733]

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

Part of: M-MACH-103351 - SP A: Globales Produktionsmanagement

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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 regarding this course:

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.
4.43 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-104747]

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

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Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I must have been passed.

Below you will find excerpts from events regarding this course:

Technical Thermodynamics and Heat Transfer I
2165501, WS 18/19, 4 SWS, Open in study portal

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
4.44 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

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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 regarding this course:

Technical Thermodynamics and Heat Transfer II
2166526, SS 2018, 3 SWS, Open in study portal

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
### Course: Tutorial Engineering Mechanics I [T-MACH-100528]

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

**Organisation:** KIT Department of Mechanical Engineering  

**Events**

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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 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 regarding this course:

**Tutorial Engineering Mechanics I**

2161246, WS 18/19, 2 SWS, Open in study portal

**Learning Content**

see lecture Engineering Mechanics I

**Workload**

time of attendance: 21h; self-study: 49h

**Literature**

see lecture Engineering Mechanics I
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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**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 regarding 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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Exams
SS 2018 76-T-MACH-105202 Tutorial Engineering Mechanics III Prüfung (PR) Seemann
WS 18/19 76-T-MACH-105202 Tutorial Engineering Mechanics III Prüfung (PR) Seemann

Competence Certificate
Attestations, successful accomplishment of exercise sheets

Prerequisites
None

Below you will find excerpts from events regarding 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.
4.48 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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**Competence Certificate**
Attestations, successful accomplishment of exercise sheets

Below you will find excerpts from events regarding 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: Vehicle Comfort and Acoustics I [T-MACH-105154]

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

Part of: M-MACH-103349 - SP C: Kraftfahrzeugtechnik

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Competence Certificate

Oral Examination

Duration: 30 up to 40 minutes
Auxiliary means: none

Prerequisites

Can not be combined with lecture T-MACH-102206

Below you will find excerpts from events regarding this course:

Vehicle Ride Comfort & Acoustics I
2114856, SS 2018, 2 SWS,

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.
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 chassis for the acoustic and mechanical driving comfort: phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

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
**Course: Vehicle Comfort and Acoustics II [T-MACH-105155]**

**Responsible:** Prof. Dr. Frank Gauterin  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-103349 - SP C: Kraftfahrzeugtechnik

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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 regarding this course:*

**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.
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.
### 4.51 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-103351 - SP A: Globales Produktionsmanagement

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

**Prerequisites**  
none
### 4.52 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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#### Events

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#### Exams

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**Competence Certificate**  
Written exam (usually about 180 min)

**Prerequisites**  
none
4.53 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-103322 - Internationales Projektmanagement und Überfachliche Qualifikationen

### Type | Credits | Recurrence | Version
---|---|---|---
Studienleistung | 4 | Each summer term | 1

#### Events

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#### 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 regarding this course:

**Working Methods in Mechanical Engineering**

<table>
<thead>
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<th>Working Methods in Mechanical Engineering</th>
<th>Lecture (V)</th>
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**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.
Curriculum of the KIT Faculty for Mechanical Engineering, for the Bachelor Course Mechanical Engineering (International) according to SPO (Study and Examination Regulations) 2017


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  2.1 Major subject options ........................................................................................................8
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## 0 List of abbreviations

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</table>
1 Curriculum, Modules and Examinations

The credit points (CP) are awarded in accordance with the „European Credit Transfer and Accumulation System“ (ECTS) and are based on the workload to be completed by students.

1.1 Examination Modalities

In each semester at least one examination date is offered for written examinations and at least two dates for oral examinations. Examination dates and deadlines for examination registration are determined by the examination board. Registration for the exams usually takes place at least one week before the exam. Enrolment and examination dates will be announced in due time, in the case of written examinations at least 6 weeks before the examination.

The examiner decides which aids may be used in an examination. A list of the approved aids will be published together with the examination date.

The following rules apply to performance reviews in the major subject modules:

The concrete form of the examinations is laid down in the Study and Examination Regulations § 6 paragraph 3.

It is possible to take the core area examinations separately. The core area examination mark is based as the average value of the components/partial performance weighted by the credit points. Changing the component/partial performance of the core area is no longer possible after the component/partial performance examinations have started. It is recommended to take the core area examinations in blocks.

In the case of major subject oral examinations, the duration of the examination should be 5 minutes per credit point. If an oral examination for a specific subject awards more than 12 CP, the duration of the examination should be 60 minutes.

1.2 Bachelor Course Modules

The module handbook indicates whether pre-requisites in the form of course achievements are required for module examinations or module component/partial performance examinations. The duration of written exams is specified in hours. Examination results are included in the module mark or the overall mark with the specified weight (W).
<table>
<thead>
<tr>
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<th>Modul/Module</th>
<th>LP/Modul/C</th>
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Curriculum of the Faculty of Mechanical Engineering for the Bachelor’s Programme Mechanical Engineering (International). Valid from October 1, 2018, on resolution of the Faculty Council on July 20, 2016, with editorial changes from July 27, 2018. For legally binding information please refer to the german version.
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Only one major subject can be chosen. The partial outputs in the core and supplementary areas for the individual major subjects can be found in the module handbook. For further information on the module focus, see Section 2 of this curriculum.
1.3 Curriculum

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1 The Materials Science Lab Course takes place during one week in the lecture break between SS and WS.

Curriculum of the Faculty of Mechanical Engineering for the Bachelor’s Programme Mechanical Engineering (International).
Valid from October 1, 2018, on resolution of the Faculty Council on July 20, 2016, with editorial changes from July 27, 2018
For legally binding information please refer to the german version.
1.4 Bachelor Thesis

The performance and marking of the bachelor thesis is regulated in § 14 of the study and examination regulations for the bachelor's degree course Mechanical Engineering (International). Further information about module description can be found in the module handbook.

2 Major Subjects/Specialization Subjects

Major subjects approved by the faculty council are listed in the module handbook.

2.1 Major/Specialization Subject Options

For the major subject, components amounting to 16 CP are chosen, of which at least 8 CP are acquired in the core area (CA). Compulsory core area component (CCA) means that the component is mandatory in the core module area, if it has not already been taken. The remaining 8 credit points can come from the supplementary area. In the context of internships, a maximum of 4 CPs may be earned as study achievements if this is an option of a major subject.

Completion of the major subject module with more than 16 LP is only permitted if the addition of the credit points of the selected sub-module examinations within the major subject module does not add up to 16 CP. Participation in further sub-module examinations is not permitted if 16 CP have already been achieved or exceeded.

The main subject mark is based on the component module exams completed with a mark. All component module marks are weighted according to their credit points. When forming the overall mark, the major subject is evaluated with 16 CP. The description of major subjects with regard to content and qualification goals as well as the components contained therein can be found in the current module handbook of the Bachelor's program.

3 Revision history (from July 20, 2016)

<table>
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<tr>
<td>May 22, 2017</td>
<td>Division of the subject International project management and interdisciplinary qualifications into two modules (1.2), editorial changes</td>
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<td>November 13, 2017</td>
<td>Changes to the list of abbreviations, removal of the module “Fundamentals of Production Engineering” (1.2), adjustment of the type of success control and the examination time for the supplementary section (1.2), adjustment of the weighting and type of success control in the module “Bachelorarbeit” (1.2), editorial changes</td>
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<td>July 27, 2018</td>
<td>Correction of SWS for Specialization (1.3) from 16 SWS to 8 SWS, additional editorial changes</td>
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Curriculum of the Faculty of Mechanical Engineering for the Bachelor's Programme Mechanical Engineering (International). Valid from October 1, 2018, on resolution of the Faculty Council on July 20, 2016, with editorial changes from July 27, 2018

For legally binding information please refer to the german version.
Studienplan der KIT-Fakultät für Maschinenbau für den Bachelorstudiengang Mechanical Engineering (International) gemäß SPO 2017

Fassung vom 27.07.2016

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2 Schwerpunkte...................................................................................................................................8
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3 Änderungshistorie (ab 20.07.2016) ..................................................................................................9
0 Abkürzungsverzeichnis

Semester:  
WS Wintersemester  
SS Sommersemester

Schwerpunkte:  
K, KP Teilleistung im Kernbereich, ggf. Pflicht des Schwerpunkts  
E Teilleistung im Ergänzungsbereich des Schwerpunkts

Leistung:  
LP Leistungspunkte  
Pr Prüfung  
mPr mündliche Prüfung  
sPr schriftliche Prüfung  
PraA Prüfungsleistung anderer Art  
Schein unbekannte Moduleistung  
TL Teilleistung  
Gew Gewichtung einer Prüfungsleistung im Modul bzw. in der Gesamtnote

Sonstiges:  
B.Sc. akademischer Grad: Bachelor of Science  
SPO Studien- und Prüfungsordnung  
SWS Semesterwochenstunden  
w wählbar  
p verpflichtend
1 Studienplan, Module und Prüfungen

Die Angabe der Leistungspunkte (LP) erfolgt gemäß dem „European Credit Transfer and Accumulation System“ (ECTS) und basiert auf dem von den Studierenden zu absolvierenden Arbeitspensum.

1.1 Prüfungsmodalitäten

In jedem Semester werden für schriftliche Prüfungen mindestens ein Prüfungstermin und für mündliche Prüfungen mindestens zwei Termine angeboten. Prüfungstermine sowie Termine, zu denen die Anmeldung zu den Prüfungen spätestens erfolgen muss, werden vom Prüfungsausschuss festgelegt. Die Anmeldung für die Prüfungen erfolgt in der Regel mindestens eine Woche vor der Prüfung. Anmelde- und Prüfungstermine werden rechtzeitig durch Anschlag bekanntgegeben, bei schriftlichen Prüfungen mindestens 6 Wochen vor der Prüfung.


Für die Erfolgskontrollen in den Schwerpunkt-Modulen gelten folgende Regeln:

Die konkrete Durchführungsform der Prüfungen ist in der Studien- und Prüfungsordnung § 6 Absatz 3 festgelegt.


1.2 Module des Bachelorstudiums

<table>
<thead>
<tr>
<th>Fach</th>
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Studienplan der Fakultät für Maschinenbau für den Bachelorstudiengang Mechanical Engineering (International).
Gültig ab 01.10.2018, auf Beschlussfassung des Fakultätsrats am 20.07.2016, mit red. Änderungen vom 27.07.2018
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Studienplan der Fakultät für Maschinenbau für den Bachelorstudiengang Mechanical Engineering (International).
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### 1.3 Studienplan

#### Teilleistungen 1. bis 4. Semester

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#### Teilleistungen 5. bis 6. Semester

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1 Das Werkstoffkunde-Praktikum findet in der vorlesungsfreien Zeit zwischen SS und WS statt und beansprucht eine Woche.
1.4 Bachelorarbeit
Die Durchführung und Benotung der Bachelorarbeit ist in § 14 der Studien- und Prüfungsordnung für den Bachelorstudiengang Mechanical Engineering (International) geregelt. Weitere Informationen können der Modulbeschreibung im Modulhandbuch entnommen werden.

2 Schwerpunkte

Die vom Fakultätsrat genehmigten Schwerpunkte sind im Modulhandbuch angegeben.

2.1 Wahlmöglichkeiten für den Schwerpunkt

Für den Schwerpunkt werden Teilleistungen im Umfang von 16 LP gewählt, davon werden mindestens 8 LP im Kernbereich (K) erworben. „KP“ bedeutet, dass die Teilleistung im Kernmodulbereich Pflicht ist, sofern sie nicht bereits belegt wurde. Die übrigen 8 Leistungspunkte können aus dem Ergänzungsbe- reich kommen. Dabei dürfen im Rahmen von Praktika höchstens 4 LP als Studienleistungen erbracht werden, falls dies in einem Schwerpunkt als Möglichkeit vorgesehen ist.

Ein Absolvieren des Schwerpunktmoduls mit mehr als 16 LP ist nur im Fall, dass die Addition der Leistungspunkte der gewählten Teilmodulprüfungen innerhalb des Schwerpunktmoduls nicht auf 16 LP aufgeht, erlaubt. Nicht zulässig ist die Teilnahme an weiteren Teilmodulprüfungen, wenn bereits 16 LP erreicht oder überschritten wurden.

## 3 Änderungshistorie (ab 20.07.2016)

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