Karlsruher Institut für Technologie

Module Handbook
KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)

SPO (none)

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KIT DEPARTMENT OF MECHANICAL ENGINEERING

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3.344. Technical Energy Systems for Buildings 1: Processes & Components - T-MACH-105559 ... 525
3.345. Technical Energy Systems for Buildings 2: System Concept - T-MACH-105560 ... 526
3.346. Technical Thermodynamics and Heat Transfer I - T-MACH-112912 ... 527
3.347. Technology of Steel Components - T-MACH-105362 ... 528
3.348. Ten Lectures on Turbulence - T-MACH-105456 ... 530

3.349. Theory of Probability - T-ETIT-101952 532
3.350. Theory of Stability - T-MACH-105372 533
3.351. Thermal Turbomachines I - T-MACH-105363 534
3.352. Thermal Turbomachines II - T-MACH-105364 535
3.353. Thermal-Fluid-Dynamics - T-MACH-106372 537
3.354. Thesis (BSc) - T-MACH-110107 539
3.355. Thesis (MSc) - T-MACH-109880 540
3.356. Thin Film and Small-scale Mechanical Behavior - T-MACH-105554 541
3.357. Tires and Wheel Development for Passenger Cars - T-MACH-102207 543
3.358. Tractors - T-MACH-105423 545
3.359. Tribology - T-MACH-105531 547
3.360. Tutorial Computational Continuum Mechanics - T-MACH-112996 549
3.361. Tutorial Continuum Mechanics of Solids and Fluids - T-MACH-110333 550
3.362. Tutorial Engineering Mechanics II - T-MACH-100284 551
3.363. Tutorial Engineering Mechanics III - T-MACH-112909 552
3.364. Tutorial Introduction to the Finite Element Method - T-MACH-110330 553
3.365. Tutorial Mathematical Methods in Micromechanics - T-MACH-110379 554
3.366. Tutorial Nonlinear Continuum Mechanics - T-MACH-111027 555
3.367. Tutorial Technical Thermodynamics and Heat Transfer I - T-MACH-112910 556
3.368. Vacuum and Tritium Technology in Nuclear Fusion - T-MACH-108784 557
3.369. Vehicle Lightweight Design - Strategies, Concepts, Materials - T-MACH-105237 558
3.370. Vehicle Systems for Urban Mobility - T-MACH-113069 560
3.371. Vibration Theory - T-MACH-105290 561
3.372. Virtual Reality Practical Course - T-MACH-102149 562
3.373. Warehousing and Distribution Systems - T-MACH-105174 563
3.374. Water Distribution Systems - T-BGU-108486 565
3.375. Welding Technology - T-MACH-105170 566
3.376. Wildcard - T-MACH-112701 568
3.377. Wildcard - T-MACH-112702 569
3.378. Wildcard - T-MACH-112698 570
3.379. Wildcard - T-MACH-112697 571
3.380. Wildcard - T-MACH-112696 572
3.381. Wildcard - T-MACH-112699 573
3.382. Wildcard - T-MACH-112703 574
3.383. Wildcard - T-MACH-112700 575
3.384. Windpower - T-MACH-105234 576
3.385. Working Methods in Materials Science and Technology - T-MACH-100288 577
3.386. Workshop Mechatronical Systems and Products - T-MACH-108680 578
3.387. Workshop on Computer-based Flow Measurement Techniques - T-MACH-106707 579

1 Study Program Structure

Mandatory	
Courses of the KIT Department of Mechanical Engineering *First usage possible from Apr 01, 2023.*	90 CP
Courses of Other KIT Departments and Interdisciplinary Qualifications *First usage possible from Apr 01, 2023.*	90 CP

1.1 Courses of the KIT Department of Mechanical Engineering

Credits
90

Note regarding usage
First usage possible from Apr 01, 2023.
The study program consists of individual bricks and an optional project, both offered by the KIT Faculty of Mechanical Engineering. In addition, further optional bricks offered by other KIT faculties can be chosen. Exchange students may select individual bricks without having to complete the entire module. Some bricks, however, may have prerequisites or possible restrictions, such as a limit on the number of participants.

Bricks should be chosen according to the Learning Agreement.

Courses of the KIT Department of Mechanical Engineering (Election:)				
M-MACH-104840	Project	DE/EN	WS+SS	30 CP
M-MACH-106250	Courses of the KIT Department of Mechanical Engineering	DE/EN	WS+SS	60 CP

1.2 Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits
90

Note regarding usage
First usage possible from Apr 01, 2023.

Courses of Other KIT Departments and Interdisciplinary Qualifications (Election:)				
M-MACH-106251	Courses of the KIT Department of Architecture	DE/EN	WS+SS	30 CP
M-MACH-105405	Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences	DE/EN	WS+SS	30 CP
M-MACH-106252	Courses of the KIT Department of Chemistry and Biosciences	DE/EN	WS+SS	30 CP
M-MACH-105100	Courses of the KIT Department of Chemical and Process Engineering	DE/EN	WS+SS	30 CP
M-MACH-104882	Courses of the KIT Department of Electrical Engineering and Information Technology	DE/EN	WS+SS	30 CP
M-MACH-106253	Courses of the KIT Department of Humanities and Social Sciences	DE/EN	WS+SS	30 CP
M-MACH-104883	Courses of the KIT Department of Informatics	DE/EN	WS+SS	30 CP
M-MACH-104885	Courses of the KIT Department of Mathematics	DE/EN	WS+SS	30 CP
M-MACH-106254	Courses of the KIT Department of Physics	DE/EN	WS+SS	30 CP
M-MACH-104884	Courses of the KIT Department of Economics and Management	DE/EN	WS+SS	30 CP
M-MACH-106255	Key Competencies	DE/EN	WS+SS	6 CP

2 Modules

M 2.1 Module: Courses of the KIT Department of Architecture [M-MACH-106251]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	1

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

Exchange Students_ARCH (Election: at most 90 credits)			
T-MACH-112696	Wildcard	15 CP	
T-MACH-112697	Wildcard	15 CP	

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Architecture.

Content
See individual bricks

M 2.2 Module: Courses of the KIT Department of Chemical and Process Engineering [M-MACH-105100]

Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	1 term	German/English	4	3

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

Exchange Students_CIW (Election: between 0 and 90 credits)			
T-CIWVT-108915	Cryogenic Engineering	6 CP	Grohmann
T-CIWVT-110571	Design of a Jet Engine Combustion Chamber	6 CP	Harth
T-CIWVT-110576	Energy from Biomass	6 CP	Bajohr, Dahmen
T-CIWVT-111095	Liquid Transportation Fuels	6 CP	Rauch
T-CIWVT-108873	Practical Course Combustion Technology	4 CP	Harth

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Chemical and Process Engineering.

Content
See brick courses

Teaching and Learning Methods
Tutorial

M 2.3 Module: Courses of the KIT Department of Chemistry and Biosciences [M-MACH-106252]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	1

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

Exchange Students_Chembio (Election: at most 90 credits)			
T-CHEMBIO-112316	Batteries and Fuel Cells	4 CP	Ehrenberg
T-CHEMBIO-112317	Hydrogen as Energy Carrier	4 CP	Ehrenberg
T-MACH-112698	Wildcard	15 CP	
T-MACH-112699	Wildcard	15 CP	

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Chemistry and Biosciences.

Content
See individual bricks

M 2.4 Module: Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences [M-MACH-105405]

Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	1 term	German/English	4	3

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

Exchange Students_BGU (Election:)			
T-BGU-100039	Applied Building Physics	3 CP	Altmann
T-BGU-110841	Fluid Mechanics of Turbulent Flows	6 CP	Uhlmann
T-BGU-100040	Building Technology	3 CP	Wirth
T-BGU-100047	Basics of Finite Elements	5 CP	Betsch
T-BGU-109908	Homework 'Basics of Finite Elements'	1 CP	Betsch
T-BGU-110842	Modeling of Turbulent Flows - RANS and LES	6 CP	Uhlmann
T-BGU-108485	Project Report Water Distribution Systems	2 CP	Oberle
T-BGU-108486	Water Distribution Systems	4 CP	Oberle

Assessment
Type and duration of the exam/ success control can vary according to the individually choice and is described in more detail within the individual brick.

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

Competence Goal
The students are able to reconstruct selected topics of Civil Engineering, Geo and Environmental Sciences.

Content
See individual bricks

M 2.5 Module: Courses of the KIT Department of Economics and Management [M-MACH-104884]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	3

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

Exchange Students_WIWI (Election: between 0 and 90 credits)			
T-WIWI-102758	Introduction to Operations Research I and II	9 CP	Nickel, Rebennack, Stein
T-WIWI-107501	Energy Market Engineering	4,5 CP	Weinhardt
T-WIWI-102864	Entrepreneurship	3 CP	Terzidis
T-WIWI-102900	Financial Analysis	4,5 CP	Luedecke
T-WIWI-107043	Liberalised Power Markets	5,5 CP	Fichtner
T-WIWI-102870	Logistics and Supply Chain Management	3,5 CP	Schultmann
T-WIWI-102800	Management Accounting 1	4,5 CP	Wouters
T-WIWI-109864	Product and Innovation Management	3 CP	Klarmann
T-WIWI-100806	Renewable Energy-Resources, Technologies and Economics	4 CP	Jochem
T-WIWI-102629	Management and Strategy	3,5 CP	Lindstädt

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Economics and Management.

Content
See individual bricks

M 2.6 Module: Courses of the KIT Department of Electrical Engineering and Information Technology [M-MACH-104882]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	7

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

Exchange Students_ETIT (Election: between 0 and 90 credits)			
T-ETIT-101918	Digital Technology	6 CP	Becker
T-ETIT-103608	Electric Power Generation and Power Grid	3 CP	Hoferer
T-ETIT-110883	Electric Power Transmission & Grid Control	6 CP	Leibfried
T-ETIT-101954	Electrical Machines and Power Electronics	6 CP	Hiller
T-ETIT-101923	Electric Energy Systems	5 CP	Leibfried
T-ETIT-109318	Electronic Devices and Circuits	6 CP	Ulusoy
T-ETIT-108386	Electrical Engineering and Electronics	8 CP	De Carne
T-ETIT-109820	Electrical Engineering and Electronics	8 CP	Doppelbauer
T-ETIT-104644	Energy Storage and Network Integration	4 CP	Noe
T-ETIT-100784	Hybrid and Electric Vehicles	4 CP	Doppelbauer
T-ETIT-100772	Lighting Engineering	4 CP	Neumann
T-ETIT-113625	Medical Imaging Technology	6 CP	Spadea
T-ETIT-113607	Medical Measurement Technology	6 CP	Nahm
T-ETIT-100694	Methods of Signal Processing	6 CP	Heizmann
T-ETIT-113630	Modeling Physiological Systems	6 CP	Loewe
T-ETIT-114690	Modeling Physiological Systems - Workshop *This item will not influence the grade calculation of this parent.*	0 CP	Loewe
T-ETIT-101939	Photovoltaics	6 CP	Powalla
T-ETIT-100763	Plastic Electronics / Polymerelectronics	3 CP	Lemmer
T-ETIT-104686	Laboratory Solar Energy	6 CP	Trampert
T-ETIT-100716	Industrial Circuitry	3 CP	Liske
T-ETIT-108344	Seminar Novel Concepts for Solar Energy Harvesting	3 CP	Richards
T-ETIT-101911	Sensors	3 CP	Menesklou
T-ETIT-100774	Solar Energy	6 CP	Paetzold, Richards
T-ETIT-110788	Superconductors for Energy Applications	5 CP	Grilli
T-ETIT-101921	System Dynamics and Control Engineering	6 CP	Hohmann
T-ETIT-100677	Systems Engineering for Automotive Electronics	4 CP	Bortolazzi
T-ETIT-101952	Theory of Probability	5 CP	Jäkel

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Electrical Engineering and Information Technology.

Content
See individual bricks

M 2.7 Module: Courses of the KIT Department of Humanities and Social Sciences [M-MACH-106253]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	1

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

Exchange Students_GeistSoz (Election: at most 90 credits)			
T-MACH-112700	Wildcard	15 CP	
T-MACH-112701	Wildcard	15 CP	

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Humanities and Social Sciences.

Content
See individual bricks

M 2.8 Module: Courses of the KIT Department of Informatics [M-MACH-104883]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	4

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

Exchange Students_INFO (Election: between 0 and 90 credits)			
T-INFO-101377	Localization of Mobile Agents	6 CP	Hanebeck
T-INFO-114169	Localization of Mobile Agents Pass	0 CP	Hanebeck
T-INFO-101294	Mechano-Informatics and Robotics	4 CP	Asfour
T-INFO-101266	Human-Machine-Interaction	6 CP	Beigl
T-INFO-106257	Human-Machine-Interaction Pass	0 CP	Beigl
T-INFO-114190	Robotics I - Introduction to Robotics	6 CP	Asfour
T-INFO-114152	Robotics II - Humanoid Robotics	3 CP	Asfour
T-INFO-114155	Robotics III - Sensors and Perception in Robotics	3 CP	Asfour
T-INFO-101310	Patent Law	3 CP	Werner

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Informatics.

Content
See individual bricks

M 2.9 Module: Courses of the KIT Department of Mathematics [M-MACH-104885]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	2

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

Exchange Students_MATH (Election: between 0 and 90 credits)			
T-MATH-103323	Differential Equations - Exam	4 CP	Grimm, Hochbruck, Neher
T-MATH-108269	Advanced Mathematics III Prerequisite	0 CP	Aksenovich, Kühnlein
T-MATH-108270	Advanced Mathematics III	7 CP	Aksenovich, Kühnlein
T-MATH-102242	Numerical Mathematics for Students of Computer Science	4,5 CP	Rieder, Weiß, Wieners
T-MATH-109620	Probability Theory and Statistics	5 CP	Bäuerle, Ebner, Fasen-Hartmann, Hug, Klar, Last, Trabs, Winter

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Mathematics.

Content
See individual bricks

M 2.10 Module: Courses of the KIT Department of Mechanical Engineering [M-MACH-106250]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of the KIT Department of Mechanical Engineering

Credits	Grading	Recurrence	Duration	Language	Level	Version
60 CP	pass/fail	Each term	2 terms	German/English	3	6

KIT Department of Mechanical Engineering Courses (Election:)			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CP	Gohl
T-MACH-105655	Alternative Powertrain for Automobiles	4 CP	Noreikat
T-MACH-108847	Applied Mathematics in Natural Science: Flows with chemical reactions	6 CP	Class
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CP	Albers, Lorentz, Matthiesen
T-MACH-105527	Applied Materials Simulation	4 CP	Gumbsch, Schneider
T-MACH-105307	Drive Train of Mobile Machines	4 CP	Geimer
T-MACH-105451	Drive Systems and Possibilities to Increase Efficiency	2 CP	Kollmeier
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CP	Düser, Ott
T-MACH-100288	Working Methods in Materials Science and Technology	2 CP	Heilmaier
T-MACH-113412	Atomistic Simulations and Particle Dynamics	4 CP	Gumbsch, Schneider, Weygand
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CP	Ulrich
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CP	Ulrich
T-MACH-105428	Selected Chapters of the Combustion Fundamentals	4 CP	Maas
T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises	4 CP	Dagan
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-MACH-105311	Design and Development of Mobile Machines	4 CP	Geimer
T-MACH-108887	Design and Development of Mobile Machines - Advance	0 CP	Geimer, Siebert
T-MACH-106732	Automated Production Systems (MEI)	4 CP	Fleischer
T-MACH-102203	Automotive Engineering I	8 CP	Gauterin, Gießler
T-MACH-114435	Automotive Engineering II	4 CP	Gießler
T-MACH-106424	Rail System Technology	4 CP	Cichon
T-MACH-110327	Production Operations Management	3 CP	Furmans
T-MACH-110326	Production Operations Management-Project	2 CP	Furmans
T-MACH-109933	Business Administration for Engineers and IT Professionals	4 CP	Sebregondi
T-MACH-105184	Fuels and Lubricants for Combustion Engines	4 CP	Kehrwald
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CP	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CP	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CP	Guber
T-MACH-113976	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	4 CP	Bauer
T-MACH-102187	CAD-NX Training Course	2 CP	Ovtcharova
T-MACH-105212	CAE-Workshop	4 CP	Düser
T-MACH-105312	CATIA Advanced	4 CP	Ovtcharova
T-MACH-105407	CFD for Power Engineering	4 CP	Otic
T-MACH-105313	CFD-Lab Using OpenFOAM	4 CP	Koch
T-MACH-102169	Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies	3 CP	Worgull

T-MACH-114110	Computational Intelligence in Mechanical Engineering	4 CP	Meisenbacher, Mikut, Reischl
T-MACH-105721	Engineer's Field of Work	2 CP	Doppelbauer, Geimer
T-MACH-105694	Data Analytics for Engineers	5 CP	Meisenbacher, Mikut, Reischl
T-MACH-113597	Decision-Making and Motion Planning for Automated Driving	6 CP	Naumann, Werling
T-MACH-112238	Holistic Approach of Managing Power Plant Operation under Uncertainty and Volatility	4 CP	Seidl
T-MACH-108407	NMR Micro Probe Hardware Conception and Construction	4 CP	Korvink
T-MACH-105540	Railways in the Transportation Market	4 CP	Cichon
T-MACH-105317	Digital Control	4 CP	Knoop
T-MACH-113016	Digitization in the Railway System	4 CP	Cichon
T-MACH-108721	Designing with Composites	4 CP	Schnack
T-MACH-105226	Dynamics of the Automotive Drive Train	4 CP	Fidlin
T-MACH-111807	Introduction to Bionics	4 CP	Hölscher
T-MACH-105320	Introduction to the Finite Element Method	3 CP	Böhlke, Langhoff
T-MACH-105525	Introduction to Nuclear Energy	4 CP	Cheng
T-MACH-105321	Introduction to Theory of Materials	4 CP	Kamlah
T-MACH-100535	Introduction into Mechatronics	6 CP	Orth, Reischl
T-MACH-111814	Introduction to Nanotechnology	4 CP	Hölscher
T-MACH-108808	Introduction to Engineering Mechanics I: Statics	3 CP	Fidlin
T-MACH-102208	Introduction to Engineering Mechanics I: Statics and Strength of Materials	5 CP	Fidlin
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CP	Fidlin
T-MACH-112215	Elasticity as a Field Theory	4 CP	Agiasofitou, Lazar
T-MACH-102211	Energy and Process Technology I	9 CP	Bauer, Maas, Schwitzke, Velji
T-MACH-102212	Energy and Process Technology II	9 CP	Maas, Schwitzke
T-MACH-105952	Energy Storage and Network Integration	4 CP	Schmidt
T-MACH-105408	Energy Systems I: Renewable Energy	4 CP	Dagan
T-MACH-105550	Energy Systems II: Reactor Physics	4 CP	Badea
T-MACH-105564	Energy Conversion and Increased Efficiency in Internal Combustion Engines	4 CP	Koch, Kubach
T-MACH-105228	Organ Support Systems	4 CP	Pylatiuk
T-MACH-110945	Exercises for Materials Characterization	2 CP	Gibmeier, Schneider
T-MACH-114408	Exercises for Microstructure-Property-Relationships	2 CP	Gruber, Kirchlechner
T-MACH-105514	Experimental Dynamics	4 CP	Fidlin
T-MACH-105512	Experimental Fluid Mechanics	4 CP	Kriegseis
T-MACH-105447	Metallographic Lab Class	4 CP	Heilmaier, Kauffmann
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups	4 CP	Dietrich
T-MACH-105152	Handling Characteristics of Motor Vehicles I	4 CP	Unrau
T-MACH-105153	Handling Characteristics of Motor Vehicles II	4 CP	Unrau
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CP	Henning
T-MACH-102207	Tires and Wheel Development for Passenger Cars	4 CP	Leister
T-MACH-105218	Automotive Vision	6 CP	Lauer, Stiller
T-MACH-113069	Vehicle Systems for Urban Mobility	4 CP	Cichon
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CP	Henning
T-MACH-105392	FEM Workshop - Constitutive Laws	4 CP	Schulz, Weygand
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CP	Bade
T-MACH-107667	Solid State Reactions and Kinetics of Phase	4 CP	Gorr, Stihl
T-MACH-105417	Finite Element Workshop	4 CP	Mattheck, Weygand
T-MACH-105474	Fluid-Structure-Interaction	4 CP	Frohnapfel, Mühlhausen

T-MACH-102093	Fluid Power Systems	4 CP	Geimer
T-MACH-105179	Functional Ceramics	4 CP	Botros
T-MACH-110331	Nuclear Fusion Technology	4 CP	Badea
T-MACH-105411	Fusion Technology A	4 CP	Perez Martin, Weiss
T-MACH-105433	Fusion Technology B	4 CP	Perez Martin, Rieth
T-MACH-105444	Combined Cycle Power Plants	4 CP	Banuti, Schulenberg
T-MACH-105157	Foundry Technology	4 CP	Günther, Klan
T-MACH-105158	Global Production and Logistics - Part 1: Global Production	4 CP	Lanza
T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics	4 CP	Furmans
T-MACH-105220	Fundamentals of Energy Technology	8 CP	Badea, Cheng
T-MACH-100092	Automotive Engineering I	8 CP	Gießler
T-MACH-102117	Automotive Engineering II	4 CP	Gießler
T-MACH-108747	Basics of Manufacturing Technology (MEI)	4 CP	Schulze
T-MACH-105379	Global Logistics	4 CP	Furmans
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CP	Schell
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CP	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-105235	Principles of Medicine for Engineers	4 CP	Pylatiuk
T-MACH-104745	Basics in Measurement and Control Systems	7 CP	Stiller
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CP	Kamlah
T-MACH-105530	Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Pants	4 CP	Sanchez-Espinoza
T-MACH-109919	Basics of Technical Logistics I	4 CP	Mittwollen
T-MACH-109920	Basics of Technical Logistics II	6 CP	Furmans
T-MACH-105213	Fundamentals of Combustion I	4 CP	Maas
T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I	2 CP	Bardehle
T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II	2 CP	Bardehle
T-MACH-111389	Fundamentals in the Development of Commercial Vehicles	4 CP	Weber
T-MACH-114075	Principles of Whole Vehicle Engineering	4 CP	Harrer
T-MACH-105398	High Performance Computing	5 CP	Nestler, Selzer
T-MACH-105459	High Temperature Materials	4 CP	Heilmaier
T-MACH-114175	Human Factors Engineering I (Workplace Design)	4 CP	Deml
T-MACH-114176	Human Factors Engineering II (Organizational Design)	4 CP	Deml
T-MACH-114616	Hydraulic Fluid Machinery I	4 CP	Pritz
T-MACH-114617	Hydraulic Fluid Machinery II	4 CP	Pritz
T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course	4 CP	Wagner
T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CP	Pundt
T-MACH-105375	Industrial Aerodynamics	4 CP	Frohnapfel, Kröber
T-MACH-105388	Introduction to Industrial Production Economics	4 CP	Dürrschnabel
T-MACH-105205	Computer Science for Engineers	6 CP	Ovtcharova
T-MACH-105206	Computer Science for Engineers, Prerequisite	0 CP	Ovtcharova
T-MACH-102128	Information Systems and Supply Chain Management	3 CP	Kilger
T-MACH-112882	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	4 CP	Albers
T-MACH-113068	Innovation and Project Management in Rail Vehicle Engineering	4 CP	Cichon
T-MACH-105404	Innovative Nuclear Systems	4 CP	Cheng
T-MACH-109185	Innovative Project	6 CP	Class, Terzidis
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CP	Schlichtenmayer
T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0	8 CP	Lanza
T-MACH-114100	Introduction to Microsystem Technology I	4 CP	Badilita, Korvink
T-MACH-114101	Introduction to Microsystem Technology II	4 CP	Badilita, Korvink

T-MACH-114755	Introduction to Multi-Body Dynamics	8 CP	Fidlin
T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	4 CP	Dagan
T-MACH-106743	IoT Platform for Engineering	4 CP	Ovtcharova
T-MACH-100287	Introduction to Ceramics	6 CP	Schell
T-MACH-110332	Nuclear Power and Reactor Technology	4 CP	Badea
T-MACH-105402	Nuclear Power Plant Technology	4 CP	Badea, Cheng
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CP	Lauer, Stiller
T-MACH-105330	Design with Plastics	4 CP	Liedel
T-MACH-100293	Structural Materials	6 CP	Guth
T-MACH-105221	Lightweight Engineering Design	4 CP	Düser, Ott
T-MACH-105786	Contact Mechanics	4 CP	Greiner
T-MACH-110377	Continuum Mechanics of Solids and Fluids	3 CP	Böhlke, Frohnapfel
T-MACH-105222	Motor Vehicle Labor	4 CP	Frey
T-MACH-105174	Warehousing and Distribution Systems	4 CP	Furmans
T-MACH-112763	Laser Material Processing	4 CP	Schneider
T-MACH-105164	Laser in Automotive Engineering	4 CP	Schneider
T-MACH-105231	Leadership and Management Development	4 CP	Ploch
T-MACH-105331	Laboratory Exercise in Energy Technology	4 CP	Bauer, Maas, Wirbser
T-MACH-110771	Logistics and Supply Chain Management	9 CP	Furmans
T-MACH-105223	Machine Vision	8 CP	Lauer, Stiller
T-MACH-105434	Magnet Technology of Fusion Reactors	4 CP	Weiss, Wolf
T-MACH-105426	Magnetohydrodynamics	4 CP	Bühler
T-MACH-105208	Machines and Processes	7 CP	Bauer, Koch, Kubach, Pritz
T-MACH-105232	Machines and Processes, Prerequisite	0 CP	Bauer, Kubach, Maas, Pritz
T-MACH-105210	Machine Dynamics	5 CP	Proppe
T-MACH-105224	Machine Dynamics II	4 CP	Proppe
T-MACH-109082	Engineering Materials for the Energy Transition	4 CP	Seifert
T-MACH-100285	Materials Physics and Metals	12 CP	Gruber, Pundt
T-MACH-110946	Materials Characterization	4 CP	Gibmeier, Schneider
T-MACH-100290	Seminar in Materials Science	2 CP	Gruber, Wagner
T-MACH-113956	Mathematical Methods in Fluid Mechanics	6 CP	Frohnapfel, Gatti
T-MACH-114062	Mathematical Models and Methods of the Theory of Thermochemical Processes	4 CP	Bykov
T-MACH-105293	Mathematical Methods in Dynamics	6 CP	Proppe
T-MACH-110378	Mathematical Methods in Micromechanics	5 CP	Böhlke
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CP	Fidlin
T-MACH-113955	Mathematical Methods in Fluid Mechanics	6 CP	Frohnapfel, Gatti
T-MACH-113942	Mathematical Models and Methods of the Theory of Thermochemical Processes	4 CP	Bykov
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CP	Baumann, Furmans
T-MACH-103622	Measurement and Control Systems	6 CP	Stiller
T-MACH-108717	Mechanics of Laminated Composites	4 CP	Schnack
T-MACH-105333	Mechanics and Strength of Polymers	4 CP	von Bernstorff
T-MACH-105334	Mechanics in Microtechnology	4 CP	Greiner, Gruber
T-MACH-105370	Laboratory Mechatronics	4 CP	Hagenmeyer, Stiller
T-MACH-105574	Mechatronical Systems and Products	3 CP	Hohmann, Matthiesen
T-MACH-105300	Measurement Instrumentation Lab	4 CP	Merkert, Stiller
T-MACH-105468	Metals	6 CP	Heilmaier, Pundt
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CP	Pfeil
T-MACH-105557	Microenergy Technologies	4 CP	Kohl, Xu

T-MACH-114399	Microstructure-Property-Relationships	5 CP	Gruber, Kirchlechner
T-MACH-105782	Micro Magnetic Resonannce	4 CP	Korvink, MacKinnon
T-MACH-101910	Microactuators	4 CP	Kohl
T-MACH-105303	Modelling of Microstructures	4 CP	August, Nestler
T-MACH-108383	Microsystem Simulation	4 CP	Korvink
T-MACH-105168	Mobile Machines	8 CP	Geimer
T-MACH-114061	Model Reduction Methods for Modeling and Simulation of Reacting Flows	4 CP	Bykov
T-MACH-105297	Modeling and Simulation	7 CP	Furmans, Geimer, Kärger
T-MACH-105396	Modeling of Thermodynamical Processes	6 CP	Maas, Schießl
T-MACH-114488	Modelling and Simulation	4 CP	Nestler
T-MACH-114489	Modelling and Simulation - Computer Lab	1 CP	Nestler
T-MACH-105539	Modern Control Concepts I	4 CP	Groell, Matthes
T-MACH-105337	Engine Laboratory	4 CP	Wagner
T-MACH-105169	Engine Measurement Techniques	4 CP	Bernhardt
T-MACH-102152	Novel Actuators and Sensors	4 CP	Kohl, Sommer
T-MACH-111026	Nonlinear Continuum Mechanics	6 CP	Böhlke
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CP	Wörner
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CP	Grötzbach
T-MACH-105338	Numerical Fluid Mechanics	4 CP	Frohnapfel, Gatti
T-MACH-110838	Numerical Fluid Mechanics with PYTHON	4 CP	Frohnapfel, Gatti
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CP	Zacharias
T-MACH-111391	Phase Transformations in Materials	4 CP	Heilmaier
T-MACH-102102	Physical Basics of Laser Technology	5 CP	Schneider
T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle	4 CP	Dagan
T-MACH-110818	Plasticity of Metals and Intermetallics	8 CP	Heilmaier, Schliephake
T-MACH-105516	Multi-Scale Plasticity	4 CP	Greiner, Schulz
T-MACH-102137	Polymer Engineering I	4 CP	Liebig
T-MACH-102138	Polymer Engineering II	4 CP	Liebig
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CP	Worgull
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CP	Worgull
T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CP	Worgull
T-MACH-105178	Practical Course Technical Ceramics	4 CP	Schell
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques	4 CP	Bauer
T-MACH-102154	Laboratory Laser Materials Processing	4 CP	Schneider
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CP	Merkert, Stiller
T-MACH-102164	Practical Training in Basics of Microsystem Technology	4 CP	Last
T-MACH-114095	Principles of Whole Vehicle Engineering	4 CP	Harrer
T-MACH-113873	Probabilistic Measurement and Estimation	4 CP	Stiller
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CP	Kienzle, Steegmüller
T-MACH-105383	Product Development - Dimensioning of Components	7 CP	Dietrich, Schulze
T-MACH-105346	Production Techniques Laboratory	4 CP	Deml, Fleischer, Furmans, Ovtcharova
T-MACH-105523	Productivity Management in Production Systems	4 CP	Stowasser
T-MACH-102156	Project Workshop: Automotive Engineering	6 CP	Frey, Gießler
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CP	Geerling, Geimer
T-MACH-105348	Process Simulation in Forming Operations	4 CP	Helm
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CP	Schell
T-MACH-110796	Python Algorithms for Vehicle Technology	4 CP	Rhode
T-MACH-102107	Quality Management	4 CP	Lanza
T-MACH-105405	Reactor Safety I: Fundamentals	4 CP	Sanchez-Espinoza

T-MACH-105349	Computational Dynamics	4 CP	Proppe
T-MACH-105350	Computational Vehicle Dynamics	4 CP	Proppe
T-MACH-112987	Computational Continuum Mechanics	3 CP	Böhlke
T-MACH-105384	Computerized Multibody Dynamics	4 CP	Boy
T-MACH-105351	Computational Mechanics I	6 CP	Böhlke, Langhoff
T-MACH-105352	Computational Mechanics II	6 CP	Böhlke, Langhoff
T-MACH-114060	Model Reduction Methods for Modeling and Simulation of Reacting Flows	4 CP	Bykov
T-MACH-105724	Failure Analysis	4 CP	Greiner, Schneider
T-MACH-105353	Rail Vehicle Technology	4 CP	Cichon
T-MACH-105170	Welding Technology	4 CP	Farajian
T-MACH-112106	Fatigue of Materials	4 CP	Guth
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CP	Fidlin
T-MACH-105171	Safety Engineering	4 CP	Kany
T-MACH-105172	Simulation of Coupled Systems	4 CP	Geimer
T-MACH-108888	Simulation of Coupled Systems - Advance	0 CP	Geimer
T-MACH-105445	Simulator Exercises Combined Cycle Power Plants	2 CP	Banuti, Schulenberg
T-MACH-105400	Scaling in Fluid Dynamics	4 CP	Bühler
T-MACH-106493	Solar Thermal Energy Systems	4 CP	Dagan
T-MACH-105372	Theory of Stability	6 CP	Fidlin
T-MACH-111821	Control of Mobile Machines	4 CP	Becker, Geimer
T-MACH-111820	Control of Mobile Machines – Prerequisites	0 CP	Becker, Geimer
T-MACH-105185	Control Technology	4 CP	Gönnheimer
T-MACH-105696	Strategic Product Development - Identification of Potentials of Innovative Products	3 CP	Siebe
T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study	1 CP	Siebe
T-MACH-105422	Flows with Chemical Reactions	4 CP	Class
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CP	Cheng
T-MACH-105970	Structural Analysis of Composite Laminates	4 CP	Kärger
T-MACH-102103	Superhard Thin Film Materials	4 CP	Ulrich
T-MACH-114033	Sustainable Product Engineering	4 CP	Ziegahn
T-MACH-114552	System Integration in Micro- and Nanotechnology I	4 CP	Gengenbach
T-MACH-114553	System Integration in Micro- and Nanotechnology II	4 CP	Gengenbach
T-MACH-100531	Systematic Materials Selection	4 CP	Dietrich, Schulze
T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components	4 CP	Schmidt
T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept	4 CP	Schmidt
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CP	Bernhardt, Kubach, Pfeil, Toedter, Wagner
T-MACH-100283	Engineering Mechanics II	6 CP	Böhlke, Langhoff
T-MACH-112906	Engineering Mechanics III	6 CP	Proppe
T-MACH-105290	Vibration Theory	4 CP	Fidlin
T-MACH-112912	Technical Thermodynamics and Heat Transfer I	6 CP	Maas
T-MACH-105361	Technical Design in Product Development	4 CP	Schmid
T-MACH-105362	Technology of Steel Components	4 CP	Schulze
T-MACH-105456	Ten Lectures on Turbulence	4 CP	Otic
T-MACH-105363	Thermal Turbomachines I	6 CP	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CP	Bauer
T-MACH-106372	Thermal-Fluid-Dynamics	4 CP	Ruck
T-MACH-105554	Thin Film and Small-scale Mechanical Behavior	4 CP	Gruber, Kirchlechner, Weygand
T-MACH-105423	Tractors	4 CP	Geimer, Kremmer
T-MACH-105531	Tribology	8 CP	Dienwiebel, Scherge

T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	2 CP	Böhlke
T-MACH-109304	Excercises - Fatigue of Welded Components and Structures	1 CP	Farajian
T-MACH-109303	Exercices - Tribology	0 CP	Dienwiebel
T-MACH-107671	Exercises for Applied Materials Simulation	2 CP	Gumbsch, Schneider
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CP	Böhlke, Langhoff
T-MACH-107632	Exercises for Solid State Reactions and Kinetics of Phase Transformations	2 CP	Gorr, Stihl
T-MACH-110333	Tutorial Continuum Mechanics of Solids and Fluids	1 CP	Böhlke, Frohnapfel
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CP	Böhlke
T-MACH-112996	Tutorial Computational Continuum Mechanics	1 CP	Böhlke
T-MACH-100284	Tutorial Engineering Mechanics II	0 CP	Böhlke, Langhoff
T-MACH-112909	Tutorial Engineering Mechanics III	1 CP	Proppe
T-MACH-112910	Tutorial Technical Thermodynamics and Heat Transfer I	1 CP	Maas
T-MACH-107685	Exercises for Materials Characterization	2 CP	Gibmeier, Schneider
T-MACH-105177	Metal Forming	4 CP	Herlan
T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion	4 CP	Giegerich, Größle
T-MACH-102194	Combustion Engines I	4 CP	Koch, Kubach
T-MACH-104609	Combustion Engines II	5 CP	Koch, Kubach
T-MACH-102139	Failure of Structural Materials: Fatigue and Creep	4 CP	Gruber, Gumbsch
T-MACH-102140	Failure of Structural Materials: Deformation and Fracture	4 CP	Gumbsch, Weygand
T-MACH-102148	Gear Cutting Technology	4 CP	Klaiber
T-MACH-102149	Virtual Reality Practical Course	4 CP	Ovtcharova
T-MACH-105292	Heat and Mass Transfer	4 CP	Maas, Yu
T-MACH-105430	Heatpumps	4 CP	Maas, Wirbser
T-MACH-105529	Heat Transfer in Nuclear Reactors	4 CP	Cheng
T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components	4 CP	Bauer, Schmid
T-MACH-105416	Hydrogen Technologies	4 CP	Jedicke, Jordan
T-MACH-107684	Materials Characterization	4 CP	Gibmeier, Schneider
T-MACH-105211	Materials of Lightweight Construction	4 CP	Liebig
T-MACH-105301	Materials Science and Engineering III	8 CP	Heilmaier
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CP	Weygand
T-MACH-100295	Materials Processing Technology	6 CP	Binder, Liebig
T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems	8 CP	Fleischer
T-MACH-105234	Windpower	4 CP	Lewald
T-MACH-108680	Workshop Mechatronical Systems and Products	4 CP	Hohmann, Matthiesen

M 2.11 Module: Courses of the KIT Department of Physics [M-MACH-106254]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	2 terms	German/English	4	1

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

Exchange Students_Physics (Election: at most 90 credits)			
T-MACH-112702	Wildcard	15 CP	
T-MACH-112703	Wildcard	15 CP	

Assessment
Oral exams: duration approx. 5 min per credit point

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

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

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

Competence Goal
The students are able to reconstruct selected topics of Physics.

Content
See individual bricks

M 2.12 Module: Key Competencies [M-MACH-106255]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	pass/fail	Each term	1 term	German/English	4	1

Election Notes
Interdisciplinary qualifications (IQ) completed at the House of Competence (HoC), at the Zentrum für Angewandte Kulturwissenschaft und Studium Generale (ZAK), or at the Sprachenzentrum (SpZ), can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule, and second, assign an IQ-achievement via the tab "IQ achievements".

Key Competencies (Election:)			
T-MACH-111686	Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded	2 CP	Frohnapfel
T-MACH-111687	Self-Booking-MSc-HOC-SPZ-FORUM-Graded	2 CP	Frohnapfel

Assessment
Success is monitored within the framework of academic achievements.

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

Prerequisites
none

Competence Goal
After completing the module Key Competences students can

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

Content
The module Key Competences consists of freely selectable courses offered by the KIT-House of Competence (HoC), the Sprachenzentrums (SpZ), the Zentrums für Angewandte Kulturwissenschaft und Studium Generale (ZAK), and the brick courses contained in the elective block of key qualifications with a work load corresponding to a total of at least 2 ECTS. Upon request, the examination board may approve further courses as freely selectable subjects in the module "Key Competences".

Module Grade Calculation
Certification without grade

Additional Information
Only HoC/SPZ/ZAK courses and courses from the "Compulsory-elective block Key Competences" can be chosen.

Teaching and Learning Methods
lectures, seminars, tutorials, lab courses.

M 2.13 Module: Project [M-MACH-104840]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: Courses of the KIT Department of Mechanical Engineering

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	graded	Each term	1 term	German/English	5	1

Project (Election: at most 1 item)			
T-MACH-109880	Thesis (MSc)	30 CP	Frohnapfel
T-MACH-110107	Thesis (BSc)	15 CP	Frohnapfel
T-MACH-110106	Project work	20 CP	Frohnapfel

Assessment
The module Project consists of a written report of a scientific subject chosen by the student himself/herself or given by the supervisor. The Project work 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.

Prerequisites
none

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

Content
The student shall be allowed to make suggestions for the topic of his/her Project work.

Workload
Maximum: 900 hours.

3 Module components

T 3.1 Module component: Advanced Mathematics III [T-MATH-108270]

Coordinators: Prof. Dr. Maria Aksenovich
PD Dr. Stefan Kühnlein
Organisation: KIT Department of Mathematics
Part of: M-MACH-104885 - Courses of the KIT Department of Mathematics

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each term	1

Courses					
WT 25/26	0160000	Advanced Mathematics III (Lecture)	4 SWS	Lecture	Tuschmann
Exams					
ST 2025	7700143	Advanced Mathematics III			Thäter

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

Prerequisites
Passing scores for homework are prerequesites for the examination.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MATH-108269 - Advanced Mathematics III Prerequisite must have been passed.

T 3.2 Module component: Advanced Mathematics III Prerequisite [T-MATH-108269]

Coordinators: Prof. Dr. Maria Aksenovich
PD Dr. Stefan Kühnlein

Organisation: KIT Department of Mathematics

Part of: M-MACH-104885 - Courses of the KIT Department of Mathematics

Type	Credits	Grading	Term offered	Version
Coursework (written)	0 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	0170000	Advanced Mathematics III (Tutorial)	2 SWS	Practice	Tuschmann

Assessment
Assessment is carried out based on written homework assignments. Exact requirements will be detailed in class.

Prerequisites
None.

T 3.3 Module component: Alternative Powertrain for Automobiles [T-MACH-105655]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2133132	Sustainable Vehicle Drivetrains	3 SWS	Lecture / 🗣	Toedter
Exams					
ST 2025	76-T-MACH-105655	Sustainable Vehicle Drivetrains (Alternative Powertrain for Automobiles)			Toedter
WT 25/26	76-T-MACH-105655	Sustainable Vehicle Drivetrains			Toedter

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

Assessment
written exam

T 3.4 Module component: Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines [T-MACH-105173]

Coordinators: Dr.-Ing. Marcus Gohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2134150	Gas, lubricating oil and operating media analysis in drive train development	2 SWS	Lecture / 🗣	Gohl
Exams					
ST 2025	76--T-Mach-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines			Gohl

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination, duration approx. 25 min, no aids

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Gas, lubricating oil and operating media analysis in drive train development

Lecture (V) On-Site

2134150, SS 2025, 2 SWS, Language: German, Open in study portal

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

T 3.5 Module component: Analysis Tools for Combustion Diagnostics [T-MACH-105167]

Coordinators: Jürgen Pfeil
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2134134	Analysis tools for combustion diagnostics	2 SWS	Lecture / 🗣	Pfeil
Exams					
ST 2025	76-T-MACH-105167	Analysis Tools for Combustion Diagnostics			Pfeil
WT 25/26	76-T-MACH-105167	Analysis Tools for Combustion Diagnostics			Koch

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Analysis tools for combustion diagnostics

2134134, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

T 3.6 Module component: Applied Building Physics [T-BGU-100039]

Coordinators: Frank Altmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each term	1 semesters	3

Courses					
WT 25/26	6211909	Applied Building Physics	2 SWS	Lecture / 🗣	Vogel, Dehn, Altmann
Exams					
ST 2025	8241100039	Applied Building Physics			Dehn

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

Assessment
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
90 hours

T 3.7 Module component: Applied Materials Simulation [T-MACH-105527]

Coordinators: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice (/	Gumbsch
Exams					
ST 2025	76-T-MACH-105527	Applied Materials Modelling			Gumbsch, Schulz

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

Assessment
oral exam ca. 30 minutes

no tools or reference materials

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

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

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-107671 - Exercises for Applied Materials Simulation must have been passed.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Applied Materials Simulation

2182614, SS 2025, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Organizational issues
Die Vorlesung wir nur als Aufzeichnung angeboten!

Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (2182616)!

Weitere Informationen finden Sie in ILIAS.

Kontakt: johannes.schneider@kit.edu

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 3.8 Module component: Applied Mathematics in Natural Science: Flows with chemical reactions [T-MACH-108847]

Coordinators: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (oral)	6 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2153406	Flows with chemical reactions	2 SWS	Lecture / 🔀	Class
Exams					
ST 2025	76-T-MACH-105422	Flows with Chemical Reactions			Class

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The study performance is considered to have been passed if all exercise assignments have been successfull processed and the final colloquium (30 minutes) has been successfully passed.

no auxiliary mean

Prerequisites
none

Recommendations
Fluid Mechanics (T-MACH-105207)

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

Additional Information
The course is offered in English.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Flows with chemical reactions

2153406, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
In this lecture, students acquire a solid understanding of fundamental phenomena in reacting flows. They learn how the high temperature sensitivity of chemical reactions leads to significant simplifications in modeling, particularly by concentrating the reaction on thin layers, known as free interfaces. The students are able to understand and apply simplified chemical models, with a focus on the fluid mechanical aspects. They develop the ability to use analytical methods to solve idealized problems and to simplify more complex issues so that efficient numerical methods can be applied. Furthermore, they learn to derive fluid mechanical equations in curvilinear coordinates and apply them to suitable problems. Overall, the students are empowered to formulate simplified models for reactive flows, critically analyze them, and solve them both analytically and numerically.

Literature
Vorlesungsskript

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

T 3.9 Module component: Applied Tribology in Industrial Product Development [T-MACH-105215]

Coordinators: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Benoit Lorentz
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Assessment
oral exam (20 min)

Prerequisites
None

Workload
120 hours

T 3.10 Module component: Atomistic Simulations and Particle Dynamics [T-MACH-113412]

Coordinators: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2181740	Particle Dynamics and Atomistic Simulation	3 SWS	Lecture / Practice (/ 🗣	Weygand, Gumbsch
Exams					
ST 2025	76-T-MACH-105308	Atomistic Simulations and Particle Dynamics			Gumbsch, Weygand
ST 2025	76-T-MACH-105308-W	Atomistic Simulations and Particle Dynamics			Weygand, Gumbsch

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

Assessment
oral exam ca. 30 minutes

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Particle Dynamics and Atomistic Simulation

2181740, SS 2025, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Particle-based methods are numerical techniques used to simulate and analyse systems consisting of many discrete particles. They are particularly useful in fields where traditional continuum mechanical approaches are insufficient, such as granular materials, complex fluids, and defects in solids. In the lecture, the Discrete Element Method (DEM) for particles and Molecular Dynamics (MD) for the atomistic description of material behaviour will be covered. These methods span different length and time scales.

1. Introduction to Particle-Based Methods
   a) origin and application
   b) classification of particle-based methods
2. Fundamentals of Particle Dynamics
   a) Newtonian mechanics and conservation laws
   b) contact mechanics and friction laws
   c) kinematics and dynamics of particles
3. Discrete Element Method (DEM)
   a) principles and fundamentals
   b) numerical implementation: discretizing space and time
   c) particle detection and contact modelling
   d) application examples
4. Atomistic Methods: Molecular Dynamics (MD) and Statics (MS)
   a) fundamentals of atomistic models
   b) interaction: interatomic potentials
      i. pair potentials and their limits
      ii. many-body potentials
   c) integration methods (e.g., Verlet, Leap-Frog)
   d) periodic boundary conditions and neighbour lists
   e) applications in materials science
5. Structural Analysis:
   a) classification of neighbourhoods, distribution functions
   b) defect energy
   c) stresses, strains
6. Statistical Aspects of Atomistic Models
   a) phase space
   b) physical ensembles: microcanonical, canonical, grand canonical
   c) control of temperature, pressure, stresses: thermostats and barostats
   d) fluctuations and physical properties

The lecture covers both fundamental and advanced aspects of particle-based methods, with a particular focus on simple atomistic approaches. The accompanying computer exercises are designed to deepen and complement the lecture content through practical examples using the freely available particle simulation tool "LAMMPS" and to serve as a forum for detailed questions from students.

Objective: The student will be able to

- explain the physical principles of particle-based simulations,
- describe the application areas of particle-based simulation methods,
- apply particle-based simulation methods to address problems in materials science, materials engineering, and process engineering.

Recommended Prerequisites: mathematics, physics, and materials science

Lecture: 22.5 hours

Exercises: 12 hours

Self-study: 85.5 hours

Oral exam: approximately 30 minutes

Organizational issues
Die Vorlesung wird auf Englisch angeboten!

Literature

1. Understanding Molecular Simulation: From Algorithms to Applications, Daan Frenkel and Berend Smit (Academic Press, 2001) wie alle guten MD Bücher stark aus dem Bereich der physikalischen Chemie motiviert und auch aus diesem Bereich mit Anwendungsbeispielen gefüllt, trotzdem für mich das beste Buch zum Thema!
2. Computer simulation of liquids, M. P. Allen and Dominic J. Tildesley (Clarendon Press, Oxford, 1996) Immer noch der Klassiker zu klassischen MD Anwendungen. Weniger stark im Bereich der Nichtgleichgewichts-MD.
3. Computational Granular Dynamics. T. Pöschel, T. Schwager, Springer, 2005. Diskrete Element Methoden.
4. Lecture Slides and Exercises.

T 3.11 Module component: Automated Production Systems (MEI) [T-MACH-106732]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	3150012	Automated Production Systems	2 SWS	Lecture / 🗣	Fleischer
Exams					
ST 2025	76-T-MACH-106732	Automated Production Systems (MEI)			Fleischer
ST 2025	76-T-MACH-106732-Wdh.	Automated Production Systems (MEI)			Fleischer

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (approx. 20 min)

Prerequisites
T-MACH-102162 - Automated Manufacturing Systems must not have been started.
T-MACH-108844 - Automated Manufacturing Systems must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Automated Production Systems

3150012, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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.

Learning Outcomes:
The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.

Organizational issues
Die genauen Termine und Raum werden über die wbk-Homepage bekannt gegeben.

T 3.12 Module component: Automotive Engineering I [T-MACH-102203]

Coordinators: Prof. Dr. Frank Gauterin
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each winter term	2

Courses					
WT 25/26	2113809	Automotive Engineering I	4 SWS	Lecture / 🗣	Gießler
Exams					
ST 2025	76-T-MACH-102203	Automotive Engineering I			Gießler
WT 25/26	76-T-MACH-102203	Automotive Engineering I			Gießler

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination

Duration: 120 minutes

Auxiliary means: none

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-100092 - Automotive Engineering I must not have been started.

Additional Information
The course is offered in English.

Below you will find excerpts from courses related to this module component:

V Automotive Engineering I

2113809, WS 25/26, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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

Learning Objectives:

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

Organizational issues
You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/, students from eucor universities send an e-mail to martina.kaiser@kit.edu

Kann nicht mit LV Grundlagen der Fahrzeugtechnik I [2113805] kombiniert werden.

Can not be combined with lecture [2113805] Grundlagen der Fahrzeugtechnik I.

Literature
1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichister 2015

2. Onori, S. / Serrao, L: / Rizzoni, G.: Hybrid Electric Vehicles - Energy Management Strategies, Springer London, Heidelberg, New York, Dordrecht 2016

3. Reif, K.: Brakes, Brake Control and Driver Assistance Systems - Function, Regulation and Components, Springer Vieweg, Wiesbaden 2015

4. Gauterin, F. / Gießler, M. / Gnadler, R.: Scriptum zur Vorlesung 'Automotive Engineering I', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

T 3.13 Module component: Automotive Engineering I [T-MACH-100092]

Coordinators: Dr.-Ing. Martin Gießler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Language	Version
Written examination	8 CP	graded	Each winter term	1 semesters		4

Courses					
WT 25/26	2113805	Automotive Engineering I	4 SWS	Lecture / 🗣	Gießler
Exams					
ST 2025	76-T-MACH-100092	Automotive Engineering			Gießler
WT 25/26	76-T-MACH-100092	Automotive Engineering			Gießler

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination

Duration: 120 minutes

Auxiliary means: none

Prerequisites
The module component "T-MACH-102203 - Automotive Engineering I" is not started or finished. The module components "T-MACH-100092 - Grundlagen der Fahrzeugtechnik I" and "T-MACH-102203 - Automotive Engineering I" can not be combined.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-102203 - Automotive Engineering I must not have been started.

Additional Information
The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Automotive Engineering I

2113805, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performance, mechanics of longitudinal and lateral forces, active and passive safety

3. Drive systems: combustion engine, hybrid and electric drive systems

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

5. Power transmission and distribution: drive shafts, cardon joints, differentials

Learning Objectives:

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

Organizational issues

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2113809] kombiniert werden.

Can not be combined with lecture [2113809].

Literature

1. Mitschke, M. / Wallentowitz, H.: Dynamik der Kraftfahrzeuge, Springer Vieweg, Wiesbaden 2014

2. Pischinger, S. / Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Springer Vieweg, Wiesbaden 2016

3. Gauterin, F. / Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung "Grundlagen der Fahrzeugtechnik I", KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

T 3.14 Module component: Automotive Engineering II [T-MACH-114435]

Coordinators: Dr.-Ing. Martin Gießler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2114855	Automotive Engineering II	2 SWS	Lecture / 🗣	Gießler

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written Examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
Only one out of the two moduls "M-MACH-102117 - Grundlagen der Fahrzeugtechnik II"and "M-MACH-114435 - Automotive Engineering II" is allowed.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-102117 - Automotive Engineering II must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Automotive Engineering II

2114855, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of the designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
Elective literature:

1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichester 2015
2. Heißing, B. / Ersoy, M.: Chassis Handbook - fundamentals, driving dynamics, components, mechatronics, perspectives, Vieweg+Teubner, Wiesbaden 2011
3. Gießler, M. / Gnadler, R.: Script to the lecture "Automotive Engineering II", KIT, Institut of Vehicle System Technology, Karlsruhe, annual update

T 3.15 Module component: Automotive Engineering II [T-MACH-102117]

Coordinators: Dr.-Ing. Martin Gießler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2114835	Automotive Engineering II	2 SWS	Lecture / 🗣	Gießler
ST 2025	2114855	Automotive Engineering II	2 SWS	Lecture / 🗣	Gießler
Exams					
ST 2025	76-T-MACH-102117	Automotive Engineering II			Gießler
ST 2025	76-T-MACH-102117_mdl.	Automotive Engineering II			Gießler
WT 25/26	76-T-MACH-102117	Automotive Engineering II			Gießler
WT 25/26	76T-MACH-102117-2	Automotive Engineering II			Gießler

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

Assessment
Written Examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
Only one out of the two moduls "M-MACH-102117 - Grundlagen der Fahrzeugtechnik II"and "M-MACH-114435 - Automotive Engineering II" is allowed.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114435 - Automotive Engineering II must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Automotive Engineering II

2114835, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle bodywork and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Organizational issues
Kann nicht mit der Veranstaltung [2114855] kombiniert werden.

Can not be combined with lecture [2114855]

Literature
1. Heißing, B. / Ersoy, M.: Fahrwerkhandbuch: Grundlagen, Fahrdynamik, Komponenten, Systeme, Mechatronik, Perspektiven, Springer Vieweg, Wiesbaden, 2013

2. Breuer, B. / Bill, K.-H.: Bremsenhandbuch: Grundlagen - Komponenten - Systeme - Fahrdynamik, Springer Vieweg, Wiesbaden, 2017

3. Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung 'Grundlagen der Fahrzeugtechnik II', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährliche Aktualisierung

V Automotive Engineering II

Lecture (V)
On-Site

2114855, SS 2025, 2 SWS, Language: English, Open in study portal

Content

1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of the designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
Elective literature:

1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichester 2015
2. Heißing, B. / Ersoy, M.: Chassis Handbook - fundamentals, driving dynamics, components, mechatronics, perspectives, Vieweg+Teubner, Wiesbaden 2011
3. Gießler, M. / Gnadler, R.: Script to the lecture "Automotive Engineering II", KIT, Institut of Vehicle System Technology, Karlsruhe, annual update

T 3.16 Module component: Automotive Vision [T-MACH-105218]

Coordinators: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	3

Courses					
ST 2025	2138340	Automotive Vision	3 SWS	Lecture / 🗣	Lauer, Bätz
Exams					
ST 2025	76-T-MACH-105218	Automotive Vision			Stiller, Lauer

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
none

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Automotive Vision

2138340, SS 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Lernziele (EN):

Machine perception and interpretation of the environment for the basis for the generation of intelligent behaviour. Especially visual perception opens the door to novel automotive applications. First driver assistance systems can already improve safety, comfort and efficiency in vehicles. Yet, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator. The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on ßeeing vehicles'. Application examples from cutting-edge and future driver
assistance systems illustrate the discussed subjects.

Lehrinhalt (EN):

1. Driver assistance systems
2. Binocular vision
3. Feature point methods
4. Optical flow/tracking in images
5. Tracking and state estimation
6. Self-localization and mapping
7. Lane recognition
8. Behavior recognition

Nachweis: Written examination 60 minutes

Arbeitsaufwand (EN): 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 3.17 Module component: Basics in Measurement and Control Systems [T-MACH-104745]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each winter term	4

Courses					
WT 25/26	2137301	Measurement and Control Systems	3 SWS	Lecture / 🗣	Stiller
WT 25/26	2137302	Measurement and Control Systems (Tutorial)	1 SWS	Practice / 🗣	Stiller
WT 25/26	3137020	Measurement and Control Systems	3 SWS	Lecture / 🗣	Stiller
WT 25/26	3137021	Measurement and Control Systems (Tutorial)	1 SWS	Practice / 🗣	Stiller
Exams					
ST 2025	76-T-MACH-104745	Basis of Measurement and Control Systems			Stiller
WT 25/26	76-T-MACH-104745	Basis of Measurement and Control Systems			Stiller

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

Assessment
written exam

2,5 hours

Prerequisites
none

Additional Information
The course is offered in German

Workload
210 hours

Below you will find excerpts from courses related to this module component:

V **Measurement and Control Systems** — **Lecture (V) On-Site**
2137301, WS 25/26, 3 SWS, Language: German, Open in study portal

Content
Lehrinhalt (EN):

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

Lernziele (EN):

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

Voraussetzungen (EN)

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

Nachweis (EN)

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

Arbeitsaufwand (EN):

210 hours

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

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York, 1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- 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
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

V **Measurement and Control Systems** — **Lecture (V) On-Site**
3137020, WS 25/26, 3 SWS, Language: English, Open in study portal

Content
Lehrinhalt (EN):

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

Lernhziele (EN):

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

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

Arbeitsaufwand (EN): 180 hours

Literature

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York,1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- 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
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

V Measurement and Control Systems (Tutorial)

Practice (Ü)
On-Site

3137021, WS 25/26, 1 SWS, Language: English, Open in study portal

Content
Tutorial for Measurement and Control Systems

T 3.18 Module component: Basics of Finite Elements [T-BGU-100047]

Coordinators: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	5 CP	graded	Each term	1 semesters	2

Courses					
WT 25/26	6215901	Basics of Finite Elements	2 SWS	Lecture / 🗣	Franke
WT 25/26	6215902	Exercises to Basics of Finite Elements	2 SWS	Practice / 🗣	Zähringer
Exams					
ST 2025	8243100047	Fundamentals of Finite Elements			Betsch, Franke

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
150 hours

T 3.19 Module component: Basics of Manufacturing Technology (MEI) [T-MACH-108747]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	3118092	Basics of Manufacturing Technology	2 SWS	Lecture / 🗣	Schulze
Exams					
ST 2025	76-T-MACH-108747	Basics of Manufacturing Technology (MEI)			Schulze

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (duration: 60 min)

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Basics of Manufacturing Technology**
3118092, WS 25/26, 2 SWS, Language: English, Open in study portal
Lecture (V) On-Site

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

Learning Outcomes:

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.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Vorlesungstermine, Vorlesungsunterlagen und weitere Informationen werden über Ilias bekannt gegeben.
The lecture notes and further information on onganisation of the lecture will be available on ILIAS.

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/)
bereitgestellt.

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

T 3.20 Module component: Basics of Technical Logistics I [T-MACH-109919]

Coordinators: Dr.-Ing. Martin Mittwollen
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2117095	Basics of Technical Logistics I	4 SWS	Lecture / Practice (/ 🗣	Mittwollen
Exams					
ST 2025	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen
WT 25/26	76-T-MACH-109919	Basics of Technical Logistics I			Mittwollen

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Prerequisites
none

Recommendations
Knowledge of the basics of technical mechanics preconditioned.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Basics of Technical Logistics I

2117095, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

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

Students are able to:

- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines
- Model real machines applying knowledge from lessons and calculate their dimensions.

Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schritflichen oder mündlichen Prüfung (nach §4 (2), 1 bzw. 2SPO).
The assessment consists of a written or oral exam according to Section 4 (2), 1 or 2of the examination regulation.
Es wird Kenntnis der Grundlagen der Technischen Mechanik vorausgesetzt.
Basics knowledge of technical mechanics is preconditioned.
Ergänzungsblätter, Präsentationen,Tafel.
Supplementary sheets, presentations, blackboard.
Präsenz: 48Std
Nacharbeit: 132Std
presence: 48h
rework: 132h

Literature
Empfehlungen in der Vorlesung / Recommendations during lessons

T 3.21 Module component: Basics of Technical Logistics II [T-MACH-109920]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Exams			
WT 25/26	76-T-MACH-109920	Basics of Technical Logistics II	Mittwollen

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

Prerequisites
none

Recommendations
Knowledge of the basics of technical mechanics and out of "Basic of Technical Logstics I" (T-MACH-109919) preconditioned.

Workload
150 hours

T 3.22 Module component: Batteries and Fuel Cells [T-CHEMBIO-112316]

Coordinators: Prof. Dr. Helmut Ehrenberg
Organisation: KIT Department of Chemistry and Biosciences
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Each winter term	1 semesters	2

Courses					
WT 25/26	5072	Batteries and Fuel Cells	2 SWS	Lecture / 🗣	Ehrenberg, Scheiba
Exams					
ST 2025	7100054	Batteries and Fuel Cells			Ehrenberg

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Workload
120 hours

T 3.23 Module component: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I [T-MACH-100966]

Coordinators: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2141864	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2025	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber
WT 25/26	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (75 Min.)

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I

2141864, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
BioMEMS I-Klausur: Mo, 23.03.2026, 17:30 - 19:30; 10.21 Gottlieb-Daimler-Hörsaal
BioMEMS II-Klausur: Mo, 02.03.2026, 8:00 - 10:00; 10.21 Gottlieb-Daimler-Hörsaal
BioMEMS III-Klausur: Mo, 09.03.2026, 13:15 - 15:15; 10.21 Gottlieb-Daimler-Hörsaal

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

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.24 Module component: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

Coordinators: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2025	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber
WT 25/26	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam (75 Min.)

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II

Lecture (V) On-Site

2142883, SS 2025, 2 SWS, Language: German, Open in study portal

Content
Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
LabCD, Protein Cristallisation
Microarrys
Tissue Engineering
Cell Chip Systems
Drug Delivery Systems
Micro reaction technology
Microfluidic Cells for FTIR-Spectroscopy
Microsystem Technology for Anesthesia, Intensive Care and Infusion
Analysis Systems of Person´s Breath
Neurobionics and Neuroprosthesis
Nano Surgery

Organizational issues
Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.
schriftl. Prüfung: Mo, 08.09.2025, 8 - 10 Uhr; 10.11 Hertz-Hörsaal

Literature

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

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 3.25 Module component: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III [T-MACH-100968]

Coordinators: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
ST 2025	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber
WT 25/26	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam (75 Min.)

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III

2142879, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Examples of use in minimally invasive therapy
Minimally invasive surgery (MIS)
Endoscopic neurosurgery
Interventional cardiology
NOTES
OP-robots and Endosystems
License of Medical Products and Quality Management

Organizational issues
Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.
schriftl. Prüfung: Mo, 22.09.2025, 10:30 - 12:30 Uhr; 10.11 Hertz-Hörsaal

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

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 3.26 Module component: Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning [T-MACH-113976]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2169558	Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning	2 SWS	Lecture / 🗣	Bauer

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approximately 30 minutes

Prerequisites
T-MACH-113359 must not have been started.

Recommendations
Profound knowledge on thermodynamics and fluid mechanics is mandatory.

Machine and processes lecture (LVNr. 3134140) is highly recommended before taking this course.

The course requires basic knowledge in engineering mathematics and computer programming at an undergraduate level. Basic knowledge in python is strongly recommended.

We expect students to be interested in applying theoretical knowledge and translate it into real world experiments.

Additional Information
The course is offered in English.

Lectures: 90 min; Lab sessions: 90 minutes (6 weeks)

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning

Lecture (V)
On-Site

2169558, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
This lecture provides a comprehensive exploration of how small radial flow turbo machines contribute to the modern energy landscape. A typical application of such machines are pressurized fuel cells used as drive train for cars and trucks. From understanding the thermodynamics and flow characteristics of centrifugal compressors and centripetal turbines to practical experiments and the integration of machine learning techniques, students will gain a holistic understanding of the potential of turbo machines for energy conversion efficiency, emissions reduction, and performance optimization. The lecture further provides a hands on sample application of machine learning, with a specific focus on its pivotal role in developing digital twins that utilize sensory data.

During an integrated lab course, learned theoretical A.I. frameworks are applied to a turbo machine test rig for the accurate prediction of the operation and proactive prevention of surge and stall. By engaging in these experimental lab, students explore how sensory data can be leveraged to monitor and optimize the performance of centrifugal compressors. By combining theory and practical lab experience, this course equips students with the knowledge and skills necessary to leverage turbomachinery technology in shaping a sustainable and efficient future energy ecosystem.

The lecture features a distinctive structure consisting of three interconnected layers:

1. Fundamental Learning: This initial phase takes place in a traditional classroom setting where students establish a solid understanding of the subject matter.
2. Hands-On Practical Application: Students then transition to two dedicated laboratory sessions where they apply the acquired knowledge using real-life equipment, gaining valuable hands-on experience.
3. Data Analysis and Interpretation: Following the practical sessions, the lecture moves into two virtual laboratory sessions focused on data-driven techniques. Here, students analyze and interpret the data collected during the hands-on sessions, applying their newfound skills.

This unique approach endows the lecture with a marathon-like nature, requiring students to progress through these phases in sync with their peers. Collaboration is key, as lab sessions are conducted in groups, and students will consolidate and utilize data from all groups. Effective in-group and between-group communication becomes essential for the overall success of the learning experience.

The lecture duration is 21 hours, divided into theory and practical sessions.

pon completing this lecture, students will:

- Gain a comprehensive understanding of radial flow turbo machinery technology and its significance in the modern energy landscape.
- Learn the characteristics of centrifugal compressors and centripetal turbines and how they contribute to energy conversion efficiency, emissions reduction, and performance optimization.
- Engage in practical experiments to explore compressor characteristics, radial flow compressors and turbines, and surge and stall phenomena in radial compressors.
- Be introduced to machine learning principles and applications in turbomachinery technology.
- Gain hands-on experience in building digital twins from sensory data to monitor and optimize centrifugal compressor performance.
- Understand the importance of data-driven predictive maintenance and outlier detection in radial flow turbo machines.
- Learn how to use machine learning techniques to predict and prevent surge and stall issues in centrifugal compressor applications.
- Develop the knowledge and skills necessary to leverage turbomachinery technology in shaping a sustainable and efficient future energy ecosystem.

Organizational issues
Vorlesung ersetzt Vorlesung-Nr. 2169462 (Turbinen und Verdichterkonstruktionen) ab WS 2023/24

Number of participants are limited due to physical constraints of the integrated lab sessions. To enroll in the lecture, kindly complete the form below. Registration is open from **16.10.2023 (00:00:00)** to **23.10.2023 (23:59:00) (Note: The registration period will be extended until 25.10.2023 (23:59:00))**. Following the closure of the registration period, applicants will receive notifications regarding their selection, considering the limited number of available spots.

- Only master level students can be admitted to the course.
- Profound knowledge on thermodynamics and fluid mechanics is mandatory.
- Basic knowledge in python is strongly recommended.
- Machine and processes lecture is highly recommended before taking this course.
- We expect students to be interested in applying theoretical knowledge and translate it into real world experiments.
- Lecture is offered in English.

The lecture is part of the "Research Infrastructures in Research-Oriented Teaching (RIRO)" initative at KIT.

Literature
- Münzberg, H.G.: Gasturbinen - Betriebsverhalten und Optimierung, Springer Verlag, 1977.
- Traupel, W.: Thermische Turbomaschinen, Bd. I-II, Springer Verlag, 1977, 1982.
- Saravanamuttoo, H.I.H. et al: Gas Turbine Theory, 7th edition, Pearson, 2018.
- Brunton, S., Kutz, J. : Data-Driven Science and Engineering: Machine Learning, Dynamical Systems, and Control. Cambridge: Cambridge University Press. doi:10.1017/9781108380690
- gitlab.kit.edu/cihan.ates/data-driven-engineering

T 3.27 Module component: Building Technology [T-BGU-100040]

Coordinators: PD Dr.-Ing. Stephan Wirth
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each term	1 semesters	2

Courses					
WT 25/26	6211910	Building Technology	2 SWS	Lecture / 🗣	N.N.
Exams					
ST 2025	8241100040	Building Technology			Dehn

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
90 hours

T 3.28 Module component: Business Administration for Engineers and IT Professionals [T-MACH-109933]

Coordinators: Heinz-Peter Sebregondi
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	2

Courses					
ST 2025	2122303	Business Administration for Engineers and IT professionals	2 SWS	Seminar / 🗣	Sebregondi
WT 25/26	2122303	Business Administration for Engineers and IT professionals	2 SWS	Seminar / 🗣	Sebregondi
Exams					
ST 2025	76-T-MACH-109933	Business Administration for Engineers and IT professionals			Sebregondi

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

Assessment
Assessment of another type. Two presentations and six written compositions in team work. Grading: each composition 1/8 and each presentation 1/8.

Prerequisites
None

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Business Administration for Engineers and IT professionals

Seminar (S) On-Site

2122303, SS 2025, 2 SWS, Language: German/English, Open in study portal

Content
Learning content

- Competitive strategies, customer value, corporate cultures, lifecycles (technology, business, product), market leadership dynamics.
- Continuum commoditization/differentiation.
- Value chain, core and support functions.
- A company's business portfolio.
- Profit margin sensitivity.
- Profitable and non-profitable products, customers and businesses.
- Drivers of a company's value (McKinsey model), return on invested capital (ROIC), ROIC value driver tree.
- Strategic planning
- Capital investments, discounted cash flow analysis, quantifying of and dealing with risks, cost-estimating methodologies per planning stage.
- Sales, procurement/purchasing, negotiation strategies

Learning objectives

- better understand a company's business, financials and their executives/decision makers
- use the language and metrics of senior executives and hold effective conversations with them
- more effectively sell a solution's or project's operational and financial value to executives and decision makers

Organizational issues
Teilnehmerzahl ist begrenzt. / Number of participants is limited.

Literature
Understanding a company's business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)

Erfolgsfaktoren für die nachhaltige Business-Karriere: Die menschliche und die Business-Perspektive; Heinz-Peter Sebregondi (Amazon 2018)

V

Business Administration for Engineers and IT professionals

Seminar (S)
On-Site

2122303, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
Learning content

- Competitive strategies, customer value, corporate cultures, lifecycles (technology, business, product), market leadership dynamics.
- Continuum commoditization/differentiation.
- Value chain, core and support functions.
- A company’s business portfolio.
- Profit margin sensitivity.
- Profitable and non-profitable products, customers and businesses.
- Drivers of a company’s value (McKinsey model), return on invested capital (ROIC), ROIC value driver tree.
- Strategic planning
- Capital investments, discounted cash flow analysis, quantifying of and dealing with risks, cost-estimating methodologies per planning stage.
- Sales, procurement/purchasing, negotiation strategies

Learning objectives

- better understand a company’s business, financials and their executives/decision makers
- use the language and metrics of senior executives and hold effective conversations with them
- more effectively sell a solution’s or project’s operational and financial value to executives and decision makers

Organizational issues
Teilnehmerzahl ist begrenzt. Zeit und Ort siehe ILIAS / Number of participants is limited. Time and place see ILIAS.

Literature
Understanding a company's business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)

Erfolgsfaktoren für die nachhaltige Business-Karriere: Die menschliche und die Business-Perspektive; Heinz-Peter Sebregondi (Amazon 2018)

T 3.29 Module component: CAD-NX Training Course [T-MACH-102187]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (practical)	2 CP	pass/fail	Each term	2

Assessment
Practical verification as academic achievement by working on a design task on the CAD computer, duration: 60 min.

Prerequisites
None

Recommendations
Dealing with technical drawings is required.

Additional Information
For the practical course compulsory attendance exists.

Workload
60 hours

T 3.30 Module component: CAE-Workshop [T-MACH-105212]

Coordinators: Prof. Dr.-Ing. Tobias Düser
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	2

Courses					
ST 2025	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
WT 25/26	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
Exams					
ST 2025	76-T-MACH-105212	CAE-Workshop			Düser
WT 25/26	76-T-MACH-105212	CAE-Workshop			Düser

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written test (with practical part on the computer), duration 60 min.

Prerequisites
None

Additional Information
Consistent attendance on the workshop days is required for successful participation in the exam. The number of participants is limited (Module). Selection will be made by drawing lots after the end of the registration period.

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V CAE-Workshop

2147175, SS 2025, 3 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
Content:

- Introduction to the finite element analysis (FEA)
- Stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis, multi-body-simulation and structure optimization with industrial common software (the content in winter and summer term is different).
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Exam: 1h Regularly written

Regular attendance: 31.5 h

Self-study: 88.5 h

Annotation: Number of participants limited. The selection will be made by drawing after the end of the registration period.

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.

Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.

Anwesenheitspflicht

Literature
Kursunterlagen werden in Ilias bereitgestellt.
Content is provided on Ilias.

V

CAE-Workshop

2147175, WS 25/26, 3 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
Content:

- Introduction to the finite element analysis (FEA)
- Stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis and structure optimization with industrial common software.
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Regular attendance: 31.5 h

Self-study: 88.5 h

Exam: 1h written

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.

Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.

Anwesenheitspflicht

Literature
Kursunterlagen werden in Ilias bereitgestellt.

Content is provided on Ilias.

T 3.31 Module component: CATIA Advanced [T-MACH-105312]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	1

Assessment
Assessment of another type. Design project and written documentation in team work and final presentation. Grading: Project work 3/5, documentation 1/5 and presentation 1/5.

Prerequisites
none

Workload
120 hours

T 3.32 Module component: CFD for Power Engineering [T-MACH-105407]

Coordinators: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2130910	CFD for Power Engineering	2 SWS	Lecture /	Otic
Exams					
ST 2025	76-T-MACH-105407	CFD in Power Engineering			Otic

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

Assessment
Oral exam, 30 min

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V CFD for Power Engineering

2130910, SS 2025, 2 SWS, Language: English, Open in study portal

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

Content
Contents:

The course is aimed of giving the fundamental of Computational Fluid Dynamics (CFD) for energy technologies. Starting from the basic physical phenomena equations an overview on computational methods and turbulence modeling is given.
The course consists of both, a theoretical and a numerical component. The former will deal with the derivations and properties of the methods and models for CFD. The numerical part will make use of open source CFD computer program OpenFOAM to give a "hands on" insight into the simulation of turbulent flows. After completing the course you should be able to establish a connection between theory and CFD modeling and simulation for energy applications.

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.
Content
1 Introduction: What is Computational Fluid Dynamics?
2 Governing Equations
3 Numerical Methods: Introduction
4 Numerical Methods: Finite Volume
5 Numerical Methods: Solution of ordinary differential equations
6 Numerical Methods: Convergence and numerical stability
7 Turbulence and Turbulence Modelling
8 Reynolds Averaged Navier-Stokes Simulation Approach
9 Heat Transfer

CFD Project:

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

Objectives:

After completing the course students:

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

Literature
Vorlesungsskript

Projektskript und Unterlagen

An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekra, 2007.

Ferziger, J; Peric, M.: Computational Methods for Fluid Dynamics, Springer 2002.

T 3.33 Module component: CFD-Lab Using OpenFOAM [T-MACH-105313]

Coordinators: Dr.-Ing. Rainer Koch
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	1

Exams			
WT 25/26	76-T-MACH-105313	CFD-Lab Using Open Foam	Koch

Assessment
Successful solution of problems

Prerequisites
none

Workload
120 hours

T 3.34 Module component: Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies [T-MACH-102169]

Coordinators: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each term	1

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

Prerequisites
none

T 3.35 Module component: Cognitive Automobiles - Laboratory [T-MACH-105378]

Coordinators: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2138341	Cogitive Automobiles - Laboratory	3 SWS	/ 🗣	Stiller, Lauer, Blumberg
Exams					
ST 2025	76-T-MACH-105378	Cognitive Automobiles - Laboratory			Stiller

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam

30 minutes

Prerequisites
none

Additional Information
The course is offered in German

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

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Cogitive Automobiles - Laboratory

2138341, SS 2025, 3 SWS, Language: German, Open in study portal **On-Site**

Content
Lehrinhalt (EN):

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

Lernziele (EN):

The laboratory accompanies the lectures "Automotive Vision" and "Behaviour Generation for Vehicles". It will provide the opportunity of turning theoretical skills taught in the lecture to practice. The laboratory is divided into four groups with a maximum number of five students in each group. During the lessons you will be supervised by scientific staff.
The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on "seeing vehicles". Each group is given the task to extract lane markings from video images and generate a suitable trajectory which the vehicle should follow. Apart from technical aspects in a highly innovative field of automotive technology, participants have the opportunity of gathering important qualifications as i.e. implementation skills, acquisition and comprehension of suitable literature, project and team work.

Nachweis: Colloquia, final race

Arbeitsaufwand: 120 hours

Literature
Dokumentation zur SW und HW werden als pdf bereitgestellt.

T 3.36 Module component: Combined Cycle Power Plants [T-MACH-105444]

Coordinators: Prof. Dr.-Ing. Daniel Banuti
Hon.-Prof. Dr. Thomas Schulenberg

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2170490	Combined Cycle Power Plants	2 SWS	Lecture / 🗣	Banuti, Schulenberg
Exams					
ST 2025	76-T-MACH-105444	Combined Cycle Power Plants			Banuti

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

Assessment
oral exam ca. 30 min

Prerequisites
none

Recommendations
We recommend to combine the lecture with the Simulator Exercises for Combined Cycle Power Plants (T-MACH-105445).

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Combined Cycle Power Plants

2170490, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. The participants can name the most important components of the combined cycle power plant and describe their function. They can design or modify combined cycle power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of gas turbine design, steam turbine design and boiler design. On this basis, they can describe and analyze the specific behavior of the power plant components as well as the entire power plant in the grid. Participants in the lecture have a trained analytical thinking and judgment in power plant design.

Layout of a combined cycle power plant, design and operation of gas turbines, of the heat recovery steam generator, of the feedwater system and cooling systems. Design and operation of steam turbines, of the generator and its electrical systems. System response to challinging grids, protection systems, water make-up and water chemistry. Design concepts of different power plant manufacturers, innovative power plant concepts.

Literature
Die gezeigten Vorlesungsfolien und weiteres Unterrichtsmaterial werden bereitgestellt.

Ferner empfohlen:

C. Lechner, J. Seume, Stationäre Gasturbinen, Springer Verlag, 2. Auflage 2010

T 3.37 Module component: Combustion Engines I [T-MACH-102194]

Coordinators: Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2133113	CO2-neutral combustion engines and their fuels I	3 SWS	Lecture / Practice (/	Koch
Exams					
ST 2025	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Koch
WT 25/26	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Kubach, Koch

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

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

Prerequisites
none

Below you will find excerpts from courses related to this module component:

V CO2-neutral combustion engines and their fuels I

2133113, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Organizational issues
Übungstermine Donnerstags nach Bekanntgabe in der Vorlesung

T 3.38 Module component: Combustion Engines II [T-MACH-104609]

Coordinators: Dr.-Ing. Rainer Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2134151	CO2-neutral combustion engines and their fuels II	3 SWS	Lecture / Practice (/	Koch
Exams					
ST 2025	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Koch
WT 25/26	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Kubach, Koch

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

Assessment
oral examination, duration: 25 minutes, no auxiliary means

Prerequisites
none

Recommendations
Fundamentals of Combustion Engines I helpful

Below you will find excerpts from courses related to this module component:

V CO2-neutral combustion engines and their fuels II

2134151, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

T 3.39 Module component: Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies [T-MACH-105535]

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

Lightweight Design
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	4

Courses					
ST 2025	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture / 🗣	Henning
Exams					
ST 2025	76-T-MACH-114011	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning
WT 25/26	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies			Henning

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

Assessment
written exam 90 minutes

Prerequisites
T-MACH-114001, T-MACH-114002 and T-MACH-114191 must not have been started

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies

Lecture (V)
On-Site

2114053, SS 2025, 2 SWS, Language: German, Open in study portal

Content

Physical connections of fiber reinforcement

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

Resins
- Thermoplastics
- Duromeres

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

Semi-finished products - textiles

Process technologies - prepregs

Recycling of composites

Aim of this lecture:

Students know different polymer resin materials and fiber materials and can deduce their character and use.

They understand the reinforcing effect of fibers in a matrix surrounding as well as the tasks of the single components in a compound. They know about the influence of the length of fibers, their mechanical characters and performance in a polymer matrix compound.

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

Literature
Literatur Leichtbau II

[1-7]

[1] M. Flemming and S. Roth, *Faserverbundbauweisen : Eigenschaften; mechanische, konstruktive, thermische, elektrische, ökologische, wirtschaftliche Aspekte*. Berlin: Springer, 2003.

[2] M. Flemming*, et al.*, *Faserverbundbauweisen : Halbzeuge und Bauweisen*. Berlin: Springer, 1996.

[3] M. Flemming*, et al.*, *Faserverbundbauweisen : Fasern und Matrices*. Berlin: Springer, 1995.

[4] M. Flemming*, et al.*, *Faserverbundbauweisen : Fertigungsverfahren mit duroplastischer Matrix*. Berlin: Springer, 1999.

[5] H. Schürmann, *Konstruieren mit Faser-Kunststoff-Verbunden : mit ... 39 Tabellen*, 2., bearb. und erw. Aufl. ed. Berlin: Springer, 2007.

[6] A. Puck, *Festigkeitsanalyse von Faser-Matrix-Laminaten : Modelle für die Praxis*. München: Hanser, 1996.

[7] M. Knops, *Analysis of failure in fibre polymer laminates : the theory of Alfred Puck*. Berlin, Heidelberg [u.a.]: Springer, 2008.

T 3.40 Module component: Computational Continuum Mechanics [T-MACH-112987]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	3 CP	graded	Each summer term	1 semesters	3

Courses					
ST 2025	2162261	Computational Continuum Mechanics	2 SWS	Lecture / 🗣	Böhlke
Exams					
ST 2025	76-T-MACH-112987	Computational Continuum Mechanics			Böhlke

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam (90 min). Additives as announced.

Admission to the exam: Coursework in *Tutorial Computational Continuum Mechanics* (T-MACH-112996) must be passed

Prerequisites
Coursework in *Tutorial Computational Continuum Mechanics* (T-MACH-112996) must be passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112996 - Tutorial Computational Continuum Mechanics must have been passed.

Additional Information
The corresponding course is offered in German.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Computational Continuum Mechanics

2162261, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Tensor algebra

- vectors; basis transformation; dyadic product; tensors of 2nd order
- properties of 2nd order tensors: symmetry, anti-symmetry, orthogonality etc.
- eigenvalue problem, theorem of Cayley-Hamilton, invariants; tensors of higher order
- tensor algebra in curvilinear coordinate systems
- tensor analysis in curvilinear coordinate systems
- Differentiation of tensor functions

Application of tensor calculus in strength of materials

- kinematics of infinitesimal and finite deformations
- transport theorem, balance equations, stress tensor
- constitutive equations for solids and fluids
- Formulation of initial-boundary-value problems

Literature

Vorlesungsskript
Liu, I-S.: Continuum Mechanics. Springer, 2002.
Greve, R.: Kontinuumsmechanik, Springer 2003
Schade, H.: Tensoranalysis.Walter de Gruyter, New York, 1997.
Schade, H: Strömungslehre, de Gruyter 2013

T 3.41 Module component: Computational Dynamics [T-MACH-105349]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2162246	Computational Dynamics	2 SWS	Lecture /	Proppe
WT 25/26	2162246	Computational Dynamics	2 SWS	Lecture /	Proppe
Exams					
ST 2025	76-T-MACH-105349	Computational Dynamics			Proppe
WT 25/26	76-T-MACH-105349	Computational Dynamics			Proppe

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

Assessment
oral exam, duration approx. 20 min.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Computational Dynamics

2162246, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content

1. Continuum dynamics
2. Variational principles
3. Ritz method
4. Finite element method in dynamics
5. Modell order reduction
6. Numerical solution of nonlinear algebraic equations
7. Numerical solution of eigenvalue problems
8. Time integration for systems of 2nd order differential equations

Organizational issues
Für diese Vorlesung werden online Unterlagen bereitgestellt.

Literature
1. Ein Vorlesungsskript wird auf Ilias bereitgestellt!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

V Computational Dynamics

2162246, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content
1. Fundamentals of elasto-kinetics (Equations of motion, principle of Hamilton and principle of Hellinger-Reissner)
2. Differential equations for the vibration of structure elements (bars, plates)
3. Numerical solutions of the equations of motion
4. Numerical algorithms
5. Stability analyses

Organizational issues
Für die Vorlesung werden Unterlagen bereitgestellt.

Literature
1. Ein Vorlesungsskript wird bereitgestellt!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

T 3.42 Module component: Computational Intelligence in Mechanical Engineering [T-MACH-114110]

Coordinators: Stefan Meisenbacher
apl. Prof. Dr. Ralf Mikut
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2105016	Computational Intelligence in Mechanical Engineering	2 SWS	Lecture /	Mikut, Reischl
Exams					
ST 2025	76-T-MACH-114110	Computational Intelligence in Mechanical Engineering			Mikut

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

Assessment
Written exam (Duration: 1h)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Computational Intelligence in Mechanical Engineering

2105016, WS 25/26, 2 SWS, Language: German, Open in study portal

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

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

Content:

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

Learning objectives:

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

Literature

Kiendl, H.: Fuzzy Control. Methodenorientiert. Oldenbourg-Verlag, München, 1997

S. Haykin: Neural Networks: A Comprehensive Foundation. Prentice Hall, 1999

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

Blume, C, Jakob, W: GLEAM - General Learning Evolutionary Algorithm and Method: ein Evolutionärer Algorithmus und seine Anwendungen. KIT Scientific Publishing, 2009 (PDF frei im Internet)

H.-P. Schwefel: Evolution and Optimum Seeking. New York: John Wiley, 1995

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

T 3.43 Module component: Computational Mechanics I [T-MACH-105351]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	2

Exams			
ST 2025	76-T-MACH-105351	Computational Mechanics I	Böhlke, Langhoff

Assessment
oral examination, 30 min.

Prerequisites
none

Recommendations
The contents of the lectures "Mathematical Methods in Continuum Mechanics" and "Introduction to the Finite Element Method" are assumed to be known

This course is geared to MSc students of Mechanical Engineering

Workload
180 hours

T 3.44 Module component: Computational Mechanics II [T-MACH-105352]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2162296	Computational Mechanics II	2 SWS	Lecture / 🗣	Böhlke, Langhoff
Exams					
ST 2025	76-T-MACH-105352	Computational Mechanics II			Böhlke, Langhoff

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination, 30 min.

Prerequisites
none

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Computational Mechanics II

2162296, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Literature
Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998; Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002; Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000

T 3.45 Module component: Computational Vehicle Dynamics [T-MACH-105350]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2162256	Computational Vehicle Dynamics	2 SWS	Lecture /	Proppe
WT 25/26	2162256	Computational Vehicle Dynamics	2 SWS	Lecture /	Proppe
Exams					
ST 2025	76-T-MACH-105350	Computational Vehicle Dynamics			Proppe
WT 25/26	76-T-MACH-105350	Computational Vehicle Dynamics			Proppe

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

Assessment
oral exam, 20 min.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Computational Vehicle Dynamics

2162256, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

1. Introduction
2. Models of load bearing systems
3. Contact forces between wheels and roadway
4. Simulation of roadways
5. Vehicle models
6. Methods of calculation
7. Performance indicators

Literature
1. K. Popp, W. Schiehlen: Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1993
2. H.-P. Willumeit: Modelle und Modellierungsverfahren in der Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1998
3. H. B. Pacejka: Tyre and Vehicle Dynamics. Butterworth Heinemann, Oxford, 2002
4. K. Knothe, S. Stichel: Schienenfahrzeugdynamik, Springer, Berlin, 2003

V Computational Vehicle Dynamics

2162256, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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

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

1. Introduction
2. Models of load bearing systems
3. Contact forces between wheels and roadway
4. Simulation of roadways
5. Vehicle models
6. Methods of calculation
7. Performance indicators

Organizational issues
Für die Vorlesung werden Unterlagen bereitgestellt.

Literature
1. K. Popp, W. Schiehlen: Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1993
2. H.-P. Willumeit: Modelle und Modellierungsverfahren in der Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1998
3. H. B. Pacejka: Tyre and Vehicle Dynamics. Butterworth Heinemann, Oxford, 2002
4. K. Knothe, S. Stichel: Schienenfahrzeugdynamik, Springer, Berlin, 2003

T 3.46 Module component: Computer Science for Engineers [T-MACH-105205]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Exams			
ST 2025	76-T-MACH-105205	Computer Science for Engineers	Meyer

Assessment
Written exam [180 min]

Prerequisites
Computer Science for Engineers, passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105206 - Computer Science for Engineers, Prerequisite must have been passed.

Workload
180 hours

T 3.47 Module component: Computer Science for Engineers, Prerequisite [T-MACH-105206]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (practical)	0 CP	pass/fail	Each summer term	2

Exams			
ST 2025	76-T-MACH-105206	Computer Science for Engineers, Prerequisite	Meyer

Assessment
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

T 3.48 Module component: Computerized Multibody Dynamics [T-MACH-105384]

Coordinators: Felix Boy
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Assessment
Oral exam, 30 min.

Prerequisites
none

Recommendations
Knowledge of EM III/IV

Workload
120 hours

T 3.49 Module component: Constitution and Properties of Protective Coatings [T-MACH-105150]

Coordinators: Prof. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2177601	Constitution and Properties of Protective Coatings	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2025	76-T-MACH-105150	Constitution and Properties of Protective Coatings			Ulrich

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination (about 30 min)

no tools or reference materials

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Constitution and Properties of Protective Coatings

2177601, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Teaching Content:

introduction and overview

concepts of surface modification

coating concepts

coating materials

methods of surface modification

coating methods

characterization methods

state of the art of industrial coating of tools and components

new developments of coating technology

regular attendance: 22 hours
self-study: 98 hours

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

Recommendations: none

Organizational issues
Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 28.10.25.

Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 29.10.25.

Literature
Bach, F.-W.: Modern Surface Technology, Wiley-VCH, Weinheim, 2006

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.50 Module component: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

Coordinators: Prof. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2194643	Constitution and Properties of Wear resistant materials	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2025	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials			Ulrich

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination (about 30 min)

no tools or reference materials

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Constitution and Properties of Wear resistant materials

2194643, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Teaching Content:

introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellites and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

regular attendance: 22 hours
self-study: 98 hours

Basic understanding of constitution of wear-resistant materials, of the relations between constitution, properties and performance, of principles of increasing of hardness and toughness of materials as well as of the characteristics of the various groups of wear-resistant materials.

Recommendations: none

Organizational issues
Die Blockveranstaltung findet in folgendem Zeitraum statt:

11.06.-13.06.2025: jeweils von 8:00-17:15 Uhr;

Ort: KIT-CN, Geb. 681, Raum 214

Anmeldung verbindlich bis zum 04.06.2025 unter sven.ulrich@kit.edu.

Nach der Anmeldung wird Ihnen im Falle einer Online-Veranstaltung der Link zur Vorlesung per E-Mail am 10.06.2025 mitgeteilt.

Literature
Laska, R. Felsch, C.: Werkstoffkunde für Ingenieure, Vieweg Verlag, Braunschweig, 1981

Schedler, W.: Hartmetall für den Praktiker, VDI-Verlage, Düsseldorf, 1988

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

Kopien der Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.51 Module component: Contact Mechanics [T-MACH-105786]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2181220	Contact Mechanics	2 SWS	Lecture / 🗣	Greiner
Exams					
ST 2025	76-T-MACH-105786	Contact Mechanics			Greiner

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam ca. 30 minutes

Prerequisites
none

Recommendations
preliminary knowledge in mathematics, physics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Contact Mechanics** — **Lecture (V) On-Site**
2181220, SS 2025, 2 SWS, Language: German, Open in study portal

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

1. Introduction: contact area and stiffness
2. Theory of the elastic half-space
3. Contact of nonadhesive spheres: Hertz theory
4. Physics and chemistry of adhesive interactions at interfaces
5. Contact of adhesive spheres: theories of Johnson-Kendall-Roberts, Derjaguin-Muller-Toporov and Maugis-Dugdale
6. Surface roughness: topography, power spectral density, structure of real surfaces, fractal surfaces as a model, metrology
7. Contact of nonadhesive rough surfaces: theories of Greenwood-Williamson, Persson, Hyun-Pei-Robbins-Molinari
8. Contact of adhesive rough surface: theories of Fuller-Tabor, Persson and recent numerical results
9. Contact of rough spheres: theory of Greenwood-Tripp and recent numerical results
10. Lateral and sliding contact: theories of Cattaneo-Mindlin, Savkoor, Persson
11. Applications of contact mechanics

The student

- knows models for smooth and rough surfaces under non-adhesive and adhesive conditions and understands their strengths and limits
- knows fundamental scaling relations for the functional dependency between contact area, stiffness and normal force
- can apply numerical methods to study questions from materials science

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
K. L. Johnson, Contact Mechanics (Cambridge University Press, 1985)

D. Maugis, Contact, Adhesion and Rupture of Elastic Solids (Springer-Verlag, 2000)

J. Israelachvili, Intermolecular and Surface Forces (Academic Press, 1985)

T 3.52 Module component: Continuum Mechanics of Solids and Fluids [T-MACH-110377]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	3 CP	graded	Each winter term	1 semesters	8

Courses					
WT 25/26	2161252	Continuum mechanics of solids and fluids	2 SWS	Lecture / 🗣	Böhlke, Frohnapfel
Exams					
ST 2025	76-T-MACH-110377	Continuum Mechanics of Solids and Fluids			Böhlke, Frohnapfel

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination (90 min). Additives as announced

Prerequisites
Coursework in *Tutorial Continuum Mechanics of Solids and Fluids* (T-MACH-110333) must be passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110333 - Tutorial Continuum Mechanics of Solids and Fluids must have been passed.

Additional Information
The corresponding course is offered in German.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Continuum mechanics of solids and fluids

2161252, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- introduction into tensor calculus
- kinematics
- balance laws of mechanics and thermodynamics
- material theory of solids and fluids
- field equations for solids and fluids
- thermomechanical couplings
- dimensional analysis

Literature
Vorlesungsskript

Greve, R.: Kontinuumsmechanik, Springer 2003

Liu, I-S.: Continuum Mechanics. Springer, 2002

Schade, H.: Strömungslehre, de Gruyter 2013

T 3.53 Module component: Control of Mobile Machines [T-MACH-111821]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	3

Exams			
ST 2025	76-T-MACH-111821	Control of mobile machines	Becker, Geimer

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

Prerequisites
A prerequisite for participation in the examination is the preparation of a semester report. T-MACH-111820 must be passed.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-111820 - Control of Mobile Machines – Prerequisites must have been passed.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.54 Module component: Control of Mobile Machines – Prerequisites [T-MACH-111820]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Exams			
ST 2025	76-T-MACH-111820	Control of mobile machines - Advance	Becker, Geimer

Assessment
Preparation of a report on the completion of the semester task

Prerequisites
none

Additional Information
The course is offered in German.

T 3.55 Module component: Control Technology [T-MACH-105185]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2150683	Control Technology	2 SWS	Lecture / 🗣	Gönnheimer, Gönnheimer
Exams					
ST 2025	76-T-MACH-105185	Control Technology			Gönnheimer

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written Exam (60 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Control Technology** — **Lecture (V) On-Site**
2150683, SS 2025, 2 SWS, Language: German, Open in study portal

Content
The lecture control technology gives an integral overview of available control components within the field of industrial production systems.
The first part of the lecture deals with the fundamentals of signal processing and with control peripherals in the form of sensors and actors which are used in production systems for the detection and manipulation of process states.
The second part handles with the function of electric control systems in the production environment. The main focus in this chapter is laid on programmable logic controls, computerized numerical controls and robot controls. Finally the course ends with the topic of cross-linking and decentralization with the help of bus systems.
The lecture is very practice-oriented and illustrated with numerous examples from different branches.

The following topics will be covered:

- Signal processing
- Control peripherals
- Programmable logic controls
- Numerical controls
- Controls for industrial robots
- Distributed control systems
- Field bus
- Trends in the area of control technology

Learning Outcomes:

The students …

- are able to name the electrical controls which occur in the industrial environment and explain their function.
- can explain fundamental methods of signal processing. This involves in particular several coding methods, error protection methods and analog to digital conversion.
- are able to choose and to dimension control components, including sensors and actors, for an industrial application, particularly in the field of plant engineering and machine tools. Thereby, they can consider both, technical and economical issues.
- can describe the approach for projecting and writing software programs for a programmable logic control named Simatic S7 from Siemens. Thereby they can name several programming languages of the IEC 1131.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.56 Module component: Cryogenic Engineering [T-CIWVT-108915]

Coordinators: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2250140	Cryogenic Engineering	2 SWS	Lecture /	Grohmann
WT 25/26	2250141	Cryogenic Engineering - Exercises	1 SWS	Practice /	Grohmann
Exams					
ST 2025	7250140	Cryogenic Engineering			Grohmann
WT 25/26	7250140	Cryogenic Engineering			Grohmann

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

Assessment
The examination is an oral examination with a duration of about 30 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites
None

T 3.57 Module component: Data Analytics for Engineers [T-MACH-105694]

Coordinators: Stefan Meisenbacher
apl. Prof. Dr. Ralf Mikut
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	3

Courses					
ST 2025	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice (/	Mikut, Reischl
Exams					
ST 2025	76-T-MACH-105694	Datenanalyse für Ingenieure			Mikut, Reischl

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

Assessment
Written exam (Duration: 1h)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Data Analytics for Engineers

2106014, SS 2025, 3 SWS, Language: German, Open in study portal

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

Content
Content:

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

Learning objectives:

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

Literature

Vorlesungsunterlagen (ILIAS)

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe.

2008 (PDF frei im Internet)

Backhaus, K.; Erichson, B.; Plinke, W.; Weiber, R.: Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. Berlin u.a.: Springer. 2000

Burges, C.: A Tutorial on Support Vector Machines for Pattern Recognition. Knowledge Discovery and Data Mining 2(2) (1998), S. 121–167

Tatsuoka, M. M.: Multivariate Analysis. Macmillan. 1988

Mikut, R.; Loose, T.; Burmeister, O.; Braun, S.; Reischl, M.: Dokumentation der MATLAB-Toolbox SciXMiner. Techn. Ber., Forschungszentrum Karlsruhe GmbH. 2006 (Internet)

T 3.58 Module component: Decision-Making and Motion Planning for Automated Driving [T-MACH-113597]

Coordinators: Dr.-Ing. Maximilian Naumann
apl. Prof. Dr. Moritz Werling
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2137401	Decision-Making and Motion Planning for Automated Driving	3 SWS	Lecture /	Werling, Naumann
Exams					
ST 2025	76-T-MACH-113597	Decision-Making and Motion Planning for Automated Driving			Werling
WT 25/26	76T-MACH-113597_eng	Decision-Making and Motion Planning for Automated Driving			Stiller

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

Assessment
written examination, duration 60 min.

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

Prerequisites
none

Additional Information
The course is offered in English

Basic knowledge of control engineering and systems theory should be available from "Measurement and Control Systems" or from other lectures.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Decision-Making and Motion Planning for Automated Driving

2137401, WS 25/26, 3 SWS, Language: English, Open in study portal

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

Content
Kurzfassung (EN):
Driver assistance is on its way to evolve from pure driving dynamics control systems, such as ABS or ESP, to full automation. To realize new, customer-value safety and comfort systems, the primary task of active driving interventions in steering, accelerator and braking is shifting from the so-called vehicle stabilization level to the so-called vehicle guidance level, the new subject area of modern assistance systems. The challenge here is to provide optimum support for the driver without patronizing him. The next step is driving automation, in which the driving task is completely taken over, at least in certain situations. For highly and fully automated vehicles, the challenge is to produce pleasant, safe and predictable driving behavior under given uncertainties in the perception of the environment and the behavior of other road users.

Lernziele (EN):

The lecture is aimed at students of mechanical engineering and related courses who wish to acquire interdisciplinary qualifications in a future-oriented subject area. It covers control engineering, information technology and vehicle technology aspects and provides a holistic overview of the field of automated vehicle control. Practical application examples from innovative driver assistance and driving automation systems deepen and illustrate the lecture content.

Contents:

Part 1: Driver Assistance:
1) Introduction to driver assistance
2) System description and modeling
3) Assistance systems of the stabilization level
4) Assistance systems of the command level

Part 2: Driving Automation:
5) Introduction Maneuver Planning
6) Dynamic Programming
7) Linear-quadratic optimization problems
8) Model predictive control
9) Decision making under uncertainty (MDPs, reinforcement learning, imitation learning).

Prerequisites:
Basic knowledge of control engineering and systems theory should be available from "Measurement and Control Systems" or from lectures of other departments.

Nachweis: written exam

Arbeitsaufwand: 180 hours

Organizational issues
Die Vorlesung ist die Nachfolgevorlesung von LV 2138336 Verhaltensgenerierung für Fahrzeuge.

T 3.59 Module component: Design and Development of Mobile Machines [T-MACH-105311]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2113079	Design and Development of Mobile Machines	2 SWS	Lecture / 🗣	Geimer
Exams					
ST 2025	76-T-MACH-105311	Design and Development of Mobile Machines			Geimer
WT 25/26	76-T-MACH-105311	Design and Development of Mobile Machines			Geimer

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

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

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

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. T-MACH-108887 must have been passed.

Modeled Prerequisites
The following conditions have to be fulfilled:

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

Recommendations
Prior attendance of a course in the field of fluid technology, for example *Fluid Power*[2113092] or *Mathematical Methods of Hydraulics*[2113090], is recommended."

Additional Information
After completion of the lecture, studens can:

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

The number of participants is limited.

Conent:

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

Literature:

See german recommendations

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Design and Development of Mobile Machines** **Lecture (V)**
2113079, WS 25/26, 2 SWS, Language: German, Open in study portal **On-Site**

Content
Excavators and wheel loaders are highly specialized mobile machines. Their function is to loosen and pick up material and place/dump it again at a short distance.
The decisive factor for dimensioning is the capacity of the standard bucket. Using a wheel loader or excavator, the essential dimensioning steps for the design are worked through in this course. This includes, among other things

- Determining the size class and main dimensions,
- the dimensioning of an electric drive train,
- the design of the primary energy supply,
- determining the kinematics of the equipment,
- dimensioning the working hydraulics and
- strength calculations.

The entire sizing and design process for these machines is heavily influenced by the use of standards and guidelines. This aspect is also covered.

The course builds on knowledge from the fields of mechanics, strength of materials, machine elements, drive technology and fluid technology.
The course requires active participation and continuous involvement.

Recommendations:

Prior attendance of a course in the field of fluid technology, for example *Fluid Power*[2113092] or *Mathematical Methods of Hydraulics*[2113090], is recommended."

- Attendance time: 21 hours
- Self-study: 99 hours

Literature
Keine.

T 3.60 Module component: Design and Development of Mobile Machines - Advance [T-MACH-108887]

Coordinators: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each term	1

Exams			
ST 2025	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Geimer
WT 25/26	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Geimer

Assessment
Preparation of semester report

Prerequisites
none

Additional Information
The course is offered in German.

T 3.61 Module component: Design of a Jet Engine Combustion Chamber [T-CIWVT-110571]

Coordinators: Dr.-Ing. Stefan Raphael Harth
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2232310	Design of a Jet Engine Combustion Chamber	2 SWS	/ 🗣	Harth
Exams					
ST 2025	7232310	Design of a Gas Turbine Combustor			Harth

Legend: 📱 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Success control is an examination of another kind according to § 4 Abs. 2 Nr. 3 SPO.

Project: Participation and presentation as well as a final oral examination amounting to max. 30 minutes.

Prerequisites
None

T 3.62 Module component: Design of Highly Stressed Components [T-MACH-105310]

Coordinators: apl. Prof. Dr. Jarir Aktaa
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2181745	Design of highly stressed components	2 SWS	Lecture / 🗣	Aktaa
Exams					
ST 2025	76-T-MACH-105310	Design of Highly Stresses Components			Aktaa

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam ca 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Design of highly stressed components

2181745, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Contents of the lecture:

rules of common design codes

classical models for elasto-plasticity and creep

lifetime rules for creep, fatigue and creep-fatigue interaction

unified constitutive models for thermo-elasto-viscoplasticity

continuum mechanical models for damage at high temperatures

application of advanced material models in FE-codes

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

Qualification: Materials Sciense, solid mechanics II

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Organizational issues
Die Vorlesung findet ab dem 04.11.2025 statt

Literature

Viswanathan, Damage Mechanisms and Life Assessment of High-Temperature Components, ASM International, 1989.

Lemaitre, J.; Chaboche J.L.: Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

T 3.63 Module component: Design with Plastics [T-MACH-105330]

Coordinators: Dipl.-Ing. Markus Liedel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2174571	Design with Plastics	2 SWS	Block / 🗣	Liedel
Exams					
ST 2025	76-T-MACH-105330	Design with Plastics			Liedel

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 20 minutes

Prerequisites
none

Recommendations
Poly I

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Design with Plastics** **Block (B) On-Site**
2174571, SS 2025, 2 SWS, Language: German, Open in study portal

Content
Structure and properties of plastics materials,

Processing of plastics,

Behavior of plastics under environmental impacts,

Classic strength dimensioning,

Geometric dimensioning,

Plastic appropriate design,

Failure examples,

Joining of plastic parts,

Supporting simulation tools,

Structural foams,

Plastics Technology trends.

learning objectives:

Students will be able to

- distinguish polymer compounds from other construction materials regarding chemical differences, thermal behavior and solid conditions.
- discuss main plastics processes regarding advantages and disadvantages of materials selection and part geometry design and to make appropriate selections.
- analyze complex application requirements concerning material impacts on strength and to use the classic dimensioning method specific to the application to evaluate the lifetime part strength limit.
- evaluate part tolerances and geometry by appropriate methods considering molding shrinkage, production tolerances, post shrinkage, heat expansion, swelling, elastic and creep deformation.
- design plastic specific joining geometries like snap fits, screw bosses, weld seams and film hinges.
- detect classic molding failures and understand potential causes as well as to reduce the probability of molding failures by defining an optimized design.
- understand benefits and limits of selected simulation tools in the plastic technology discipline (strength, deformation, filling, warpage).
- assess polymer classes and plastic part designs with respect to suitable recycling concepts and ecological consequences.

requirements:

none,

recommendation: Polymerengineering I

workload:

The workload for the lecture Design with Plastics is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Organizational issues
Anmeldung unter Markus.Liedel@de.bosch.com

Literature
Materialien werden in der Vorlesung ausgegeben.
Literaturhinweise werden in der Vorlesung gegeben.

T 3.64 Module component: Designing with Composites [T-MACH-108721]

Coordinators: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Assessment
Oral exam, 20 minutes

Prerequisites
None

Additional Information
The lecture notes are made available via ILIAS.

Workload
120 hours

T 3.65 Module component: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Coordinators: Dr.-Ing. Gerhard Geerling
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2113072	Development of Oil-Hydraulic Powertrain Systems	2 SWS	Block / 🗣	Geerling
Exams					
ST 2025	76-T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems			Geimer
WT 25/26	76-T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems			Geimer

Legend: 💻 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (approx. 20 min)

Prerequisites
none

Additional Information
The course is offered in German .

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Development of Oil-Hydraulic Powertrain Systems

2113072, WS 25/26, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

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

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

knowledge in the fluidics

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

Organizational issues
siehe Homepage

T 3.66 Module component: Differential Equations - Exam [T-MATH-103323]

Coordinators: PD Dr. Volker Grimm
Prof. Dr. Marlis Hochbruck
PD Dr. Markus Neher

Organisation: KIT Department of Mathematics

Part of: M-MACH-104885 - Courses of the KIT Department of Mathematics

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	1

Courses					
WT 25/26	0132200	Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential equations	2 SWS	Lecture / 🗣	Grimm
WT 25/26	0132300	Exercices to Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential equations	1 SWS	Practice / 🗣	Grimm
Exams					
ST 2025	010157660908003808_HM3-Bau-Ing.	Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential Equations - Exam			Hochbruck

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Below you will find excerpts from courses related to this module component:

V Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential equations

Lecture (V) On-Site

0132200, WS 25/26, 2 SWS, Language: German, Open in study portal

V Exercices to Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential equations

Practice (Ü) On-Site

0132300, WS 25/26, 1 SWS, Language: German, Open in study portal

T 3.67 Module component: Digital Control [T-MACH-105317]

Coordinators: Prof. Dr.-Ing. Michael Knoop
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2137309	Digital Control	2 SWS	Lecture / 🗣	Knoop, Rack
Exams					
ST 2025	76-T-MACH-105317	Digital Control			Knoop, Stiller
WT 25/26	76-T-MACH-105317	Digital Control			Knoop, Stiller

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam

60 min.

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Digital Control

2137309, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Lehrinhalt (EN):

1. Introduction into digital control:
Motivation for digital implementation of controllers Structure of digital feedback control loops Sample and hold units
2. State space analysis and design:
Discretisation of continuous-time systems Discrete-time state space equations Stability - definition and criteria State feedback design by eigenvalue assignment PI state feedback controller Luenberger observer, separation theorem
Systems with dead-time Deadbeat design
3. Analysis and design based on z-transform: z-transform - definition and theorems Control loop description in the z domain
Stability criteria Root locus controller design Transfer of continuous-time controllers into discrete-time controllers

Voraussetzungen (EN):

Basic studies and preliminary examination; basic lectures in automatic control

Lernziele (EN):

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

Nachweis: oral examination; duration: 30 minutes

Arbeitsaufwand: 120 hours

Literature

- Lunze, J.: Regelungstechnik 2, 9. Auflage, Springer Verlag, Berlin Heidelberg 2016.
- Unbehauen, H.: Regelungstechnik, Band 2: Zustandsregelungen, digitale und nichtlineare Regelsysteme. 8. Auflage, Vieweg Verlag, Braunschweig 2000
- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
- Ogata, K.: Discrete-Time Control Systems. 2nd edition, Prentice-Hall, Englewood Cliffs 1994
- Ackermann, J.: Abtastregelung, Band I, Analyse und Synthese. 3. Auflage, Springer Verlag, Berlin Heidelberg 1988

T 3.68 Module component: Digital Technology [T-ETIT-101918]

Coordinators: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2311613	Accompanying group tutorial for 2311615 Digital Technology / Fundamentals of Digital Technology	1 SWS	Tutorial (/ 🗣	Gutermann
WT 25/26	2311615	Digital Technology / Fundamentals of Digital Technology	3 SWS	Lecture / 🗣	Becker
WT 25/26	2311617	Tutorial for 2311615 Digital Technology / Fundamentals of Digital Technology	1 SWS	Practice / 🗣	Gutermann
Exams					
ST 2025	7311615	Digital Technology			Becker

Legend: 📱 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.69 Module component: Digitization in the Railway System [T-MACH-113016]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Each winter term	1 semesters	2

Courses					
WT 25/26	2115920	Railway System Digitalisation	2 SWS	Lecture / 🗣	Jost, Cichon
Exams					
WT 25/26	76-T-MACH-106426	Railway System Digitalisation			Jost

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination
Duration: approx. 20 minutes
No tools or reference material may be used during the exam.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.70 Module component: Drive Systems and Possibilities to Increase Efficiency [T-MACH-105451]

Coordinators: Dr.-Ing. Hans-Peter Kollmeier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	2 CP	graded	Each winter term	1

Assessment
Oral examination, time duration 30 min., no aids

Prerequisites
none

Workload
60 hours

T 3.71 Module component: Drive Train of Mobile Machines [T-MACH-105307]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Exams			
ST 2025	76-T-MACH-105307	Drive Train of Mobile Machines	Geimer

Assessment
The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in ervery semester and can be repeated at any regular examination date.

Prerequisites
none

Recommendations

- General principles of mechanicals engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

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

Content:

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

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

Media: projector presentation

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

Workload
120 hours

T 3.72 Module component: Dynamics of the Automotive Drive Train [T-MACH-105226]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2163111	Dynamics of the Automotive Drive Train	2 SWS	Lecture / 🗣	Fidlin
WT 25/26	2163112	Dynamics of the Automotive Drive Train (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Suresh Singhal
Exams					
ST 2025	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin
WT 25/26	76-T-MACH-105226	Dynamics of the Automotive Drive Train			Fidlin

Legend: 🖥 Online, 🌍 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination, 30 min.

Prerequisites
none

Recommendations
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Dynamics of the Automotive Drive Train

2163111, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

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

Literature

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

V Dynamics of the Automotive Drive Train (Tutorial)

2163112, WS 25/26, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 3.73 Module component: Elasticity as a Field Theory [T-MACH-112215]

Coordinators: Dr. Eleni Agiasofitou
Dr. Markus Lazar

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Assessment
written exam (90 min)

Workload
120 hours

T 3.74 Module component: Electric Energy Systems [T-ETIT-101923]

Coordinators: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	2

Courses					
ST 2025	2306200	Electric Energy Systems	2 SWS	Lecture / 🗣	Hiller, Leibfried
ST 2025	2306201	Practice to Electric Energy Systems	2 SWS	Practice / 🗣	Hiller, Leibfried
ST 2025	2307391	Electric Energy Systems	2 SWS	Lecture / ✕	Leibfried
ST 2025	2307393	Übungen zu 2307391 Elektroenergiesysteme	1 SWS	Practice / ✕	Eser
Exams					
ST 2025	7307391	Electric Energy Systems			Leibfried

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.75 Module component: Electric Power Generation and Power Grid [T-ETIT-103608]

Coordinators: Dr.-Ing. Bernd Hoferer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	2

Courses					
WT 25/26	2307399	Electric Power Generation and Power Grid	2 SWS	Lecture / ✕	Hoferer
Exams					
ST 2025	737307399	Electric Power Generation and Power Grid			Hoferer

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

Prerequisites
none

T 3.76 Module component: Electric Power Transmission & Grid Control [T-ETIT-110883]

Coordinators: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Each summer term	1 semesters	2

Courses					
ST 2025	2307376	Electric Power Transmission & Grid Control	2 SWS	Lecture / 🗣	Leibfried
ST 2025	2307377	Tutorial for 2307376 Electric Power Transmission & Grid Control	2 SWS	Practice / 🗣	Weber
Exams					
ST 2025	7307376	Electric Power Transmission & Grid Control			Leibfried

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The examination takes place in form of a written examination lasting 120 minutes. The module grade is the grade of the written exam.

Prerequisites
none

T 3.77 Module component: Electrical Engineering and Electronics [T-ETIT-109820]

Coordinators: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each winter term	1

Courses					
WT 25/26	2306339	Electrical Engineering and Electronics foir Mechanical Engineers	4 SWS	Lecture / ✕	Brodatzki
Exams					
ST 2025	7306351	Electrical Engineering and Electronics for Mechanical Engineers			Brodatzki
WT 25/26	7306351	Electrical Engineering and Electronics for Mechanical Engineers			Doppelbauer

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

Additional Information
Exam will be held in german language

T 3.78 Module component: Electrical Engineering and Electronics [T-ETIT-108386]

Coordinators: Prof. Dr.-Ing. Giovanni De Carne
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each winter term	1

Courses					
WT 25/26	2306350	Electrical Engineering and Electronics for Mechanical Engineers	4 SWS	Lecture / ✕	De Carne
WT 25/26	2306351	Tutorial for 2306350 Electrical Engineering and Electronics for Mechanical Engineers	2 SWS	Practice / ✕	De Carne, Digel, Bremer, Brodatzki
Exams					
ST 2025	7306350	Electrical Engineering and Electronics for Mechanical Engineers			Brodatzki
WT 25/26	7306350	Electrical Engineering and Electronics for Mechanical Engineers			Doppelbauer

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

Assessment
The control of success takes place by a written examination, duration 3 hours.

By successfully completing two additional exercise sheets (on a voluntary basis), a bonus of up to 6 exam points can be earned (corresponds to a maximum grade improvement of the written exam by the value 0.3 or 0.4).

Prerequisites
none

Additional Information
Exam will be held in english language.

T 3.79 Module component: Electrical Machines and Power Electronics [T-ETIT-101954]

Coordinators: Prof. Dr.-Ing. Marc Hiller
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Exams			
ST 2025	7306307	Electrical Machines and Power Electronics	Hiller
WT 25/26	7306307	Electrical Machines and Power Electronics	Hiller

Prerequisites
none

T 3.80 Module component: Electronic Devices and Circuits [T-ETIT-109318]

Coordinators: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Each summer term	1 semesters	2

Courses					
ST 2025	2308655	Electronic Devices and Circuits	3 SWS	Lecture / 🗣	Ulusoy
ST 2025	2308657	Übungen zu 2312655 Elektronische Schaltungen	1 SWS	Practice / 🗣	Ulusoy
ST 2025	2308658	Tutorien zu 2312655 Elektronische Schaltungen	1 SWS	/ 🗣	Ulusoy
Exams					
ST 2025	7308655	Electronic Devices and Circuits			Ulusoy

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.81 Module component: Energy and Process Technology I [T-MACH-102211]

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

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Each winter term	1

Courses					
WT 25/26	2157961	Energy and Process Technology I	6 SWS	Lecture / Practice (/ 🗣	Bauer, Wirbser, Mitarbeiter, Wagner, Schwitzke, Reichel, Maas
Exams					
ST 2025	76-T-MACH-102211	Energy and Process Technology I			Bauer, Wirbser, Schwitzke, Pritz, Wagner
WT 25/26	76-T-MACH-102211	Energy and Process Technology I			Bauer, Wirbser, Schwitzke, Wagner

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

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

Prerequisites
none

Workload
270 hours

Below you will find excerpts from courses related to this module component:

V Energy and Process Technology I

2157961, WS 25/26, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

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

The students are able to:

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

T 3.82 Module component: Energy and Process Technology II [T-MACH-102212]

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

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Each summer term	1

Courses					
ST 2025	2170832	Energy and Process Technology II	6 SWS	Lecture / Practice (/ 🗣	Schwitzke, Pritz, Maas, Wirbser, Schmid
Exams					
ST 2025	76-T-MACH-102212	Energy and Process Technology II			Wirbser, Schwitzke, Bauer, Pritz, Wagner
WT 25/26	76-T-MACH-102212	Energy and Process Technology II			Schwitzke, Wirbser, Bauer, Wagner

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

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

Prerequisites
none

Workload
270 hours

Below you will find excerpts from courses related to this module component:

V Energy and Process Technology II

2170832, SS 2025, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Thermal Turbomaschinery - In the first part of the lecture deals with energy systems. Questions regarding global energy resources and their use, especially for the generation and provision of electrical energy, are addressed. Common fossile and nuclear power plants for the centralized supply with electrical power as well as concepts of power-heat cogeneration for the decentralized electrical power supply by means of block-unit heat and power plants, etc. are discussed. Moreover, the characteristics and the potential of renewable energy conversion concepts, such as wind and hydro-power, photovoltaics, solar heat, geothermal energy and fuel cells are compare and evaluated. The focus is on the description of the potentials, the risks and the economic feasibility of the different strategies aimed to protect resources and reduce CO2 emissions.

The students are able to:

- discuss and evaluate energy resources and reserves and their utility
- review the use of energy carriers for electrical power generation
- explain the concepts and properties of power-heat cogeneration, renewable energy conversion and fuel cells and their fields of application
- comment on and compare centralized and decentralized supply concepts
- calculate the potentials, riskis and economic feasibility of different strategies aiming at the protection of resources and the reduction of CO2 emissions
- name and judge on the options for solar energy utilization
- discuss the potential of geothermal energy and its utilization

T 3.83 Module component: Energy Conversion and Increased Efficiency in Internal Combustion Engines [T-MACH-105564]

Coordinators: Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Exams			
ST 2025	76-T-MACH-105564	Hydrogen and reFuels - Energy Conversion in Combustion Engines	Koch

Assessment
oral exam, 25 minutes, no auxillary means

Prerequisites
none

T 3.84 Module component: Energy from Biomass [T-CIWVT-110576]

Coordinators: Dr.-Ing. Siegfried Bajohr
Prof. Dr. Nicolaus Dahmen

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2231220	Energy from Biomass	2 SWS	Lecture / 🗣	Dahmen, Bajohr

Legend: 📱 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Prerequisites
None

T 3.85 Module component: Energy Market Engineering [T-WIWI-107501]

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

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2540464	Energy Market Engineering	2 SWS	Lecture /	Weinhardt, Miskiw
ST 2025	2540465	Übung zu Energy Market Engineering	1 SWS	Practice /	Semmelmann
Exams					
ST 2025	79852	Energy Market Engineering			Weinhardt

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

Assessment
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

Prerequisites
None

Recommendations
None

Additional Information
Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".

The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

Below you will find excerpts from courses related to this module component:

V Energy Market Engineering

2540464, SS 2025, 2 SWS, Language: German/English, Open in study portal

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

Content
The lecture "Energy Market Engineering" addresses the design and analysis of energy markets considering current developments and challenges. A particular focus is on the integration of renewable energies and the associated market mechanisms and regulations.

Specifically, the following topics are covered:

- **Introduction to Market Engineering**: What design elements do markets and specifically auctions have in general, and what influence does this have on participant behavior.
- **Introduction to Energy Markets**: Fundamentals and current trends in the energy system, including climate change and the expansion of renewable energies.
- **Market Design and Products**: Various pricing models such as nodal pricing, zonal pricing, and the structure of capacity markets.
- **Grid Expansion, Distribution Networks, and Flexibility Markets**: Analysis of distribution network markets and the role of flexibility options like demand response and storage technologies.
- **Intermittent Generation and Grid Stability**: Challenges posed by fluctuating renewable energies and strategies to ensure grid stability.
- **Digitalization and Market Transparency**: The role of digitalization in improving market transparency and efficiency, including the use of smart metering systems and data-driven approaches.
- **Current Research Projects and Developments**: Presentation of ongoing research projects and their significance for the future design of energy markets.

Organizational issues
Die Vorlesung findet hybrid statt, mit Videos die während des Semester von den Studierenden eigenständig durchgearbeitet werden und einer Blockveranstaltung im Juli, welche die Vorlesungsinhalte anreichert und vertieft. Mehr Infos in der Auftaktverantsaltung in Präsenz in der ersten Vorlesungswoche.

Literature

- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX *. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

T 3.86 Module component: Energy Storage and Network Integration [T-ETIT-104644]

Coordinators: Prof. Dr.-Ing. Mathias Noe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2312687	Energy Storage and Network Integration	2 SWS	Lecture / 🗣	Grilli, De Carne
WT 25/26	2312689	Tutorial for 2312687 Energy Storage and Network Integration	1 SWS	Practice / 🗣	De Carne, Grilli
Exams					
ST 2025	7312687	Energy Storage and Network Integration			De Carne, Grilli

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Success is assessed in an overall oral examination (30 minutes).

Prerequisites
The course "T-MACH-105952 – Energiespeicher und Netzintegration" must not have started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105952 - Energy Storage and Network Integration must not have been started.

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

Additional Information
Exam and Lecture will be held in English.

Below you will find excerpts from courses related to this module component:

V Tutorial for 2312687 Energy Storage and Network Integration

2312689, WS 25/26, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

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

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

Organizational issues
The exact dates of the exercises will be announced during the main lectures of the course.

T 3.87 Module component: Energy Storage and Network Integration [T-MACH-105952]

Coordinators: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189487	Energy Storage and Grid Integration	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2025	76-T-MACH-105952	Energy Storage and Grid Integration			Schmidt

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

Assessment
oral exam, about 30 minutes

Prerequisites
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-104644 - Energy Storage and Network Integration must not have been started.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Energy Storage and Grid Integration

2189487, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid.

Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

Students understand the different types of energy storage and apply their knowledge for the selection and principal dimensioning of relevant energy storage tasks.

Furthermore, students can reflect the state-of-the-art of most important energy storage types, their fundamental characterisitics and viability at given boundary conditions and they are enabled to elaborate and apply basic integration issues dependent on the grid structure for the different network types.

Oral exam, duration approximately 30 min, tools: none

Literature
M. Sterner, I. Stadler: Energiespeicher - Bedarf, Technologien, Integration. Springer 2017, https://link.springer.com/book/10.1007/978-3-662-48893-5

T 3.88 Module component: Energy Systems I: Renewable Energy [T-MACH-105408]

Coordinators: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2129901	Energy Systems I - Renewable Energy	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2025	76-T-MACH-105408	Energy Systems I: Renewable Energy			Dagan
WT 25/26	76-T-MACH-105408	Energy Systems I: Renewable Energy			Dagan

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 1/2 hour

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Energy Systems I - Renewable Energy

2129901, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course deals with fundamental aspects of renewable energies.

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

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

regular attendance: 30 hours
self-study: 90hours

Oral examination – as an elective course 30 minutes, in combination with Energiesysteme-II or other courses within the energy courses, as a major course 1 hour

Organizational issues
Diese Vorlesung findet letztmalig im WS2025/26 statt.

T 3.89 Module component: Energy Systems II: Reactor Physics [T-MACH-105550]

Coordinators: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2130929	Energy systems II: Reactor Physics	2 SWS	Lecture / 🗣	Badea
Exams					
ST 2025	76-T-MACH-105550	Energy Systems II: Reactor Physics			Badea
WT 25/26	76-T-MACH-105550	Energy Systems II: Reactor Physics			Badea

Legend: 🖥 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 20 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Energy systems II: Reactor Physics

2130929, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The goal of the course is to train the students for the field of nuclear energy using fission reactors. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. Based on the reactor physics knowledge, the students are able to understand, compare and evaluate the capabilities of different types of reactors - LWR, heavy water reactors, nuclear power systems of generation IV – as well as their fundamental nuclear safety concepts. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei,
- neutron flux, cross section, reaction rate, mean free path, chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution, power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

Organizational issues
Di (29.07.2025), 09:00 bis 17:00
Mi (30.07.2025), 09:00 bis 17:00
Do (31.07.2025), 09:00 bis 17:00

Literature

Dieter Schmidt, Reaktortechnik, Band 1: Grundlagen, ISBN 3 7650 2003 6

Dieter Schmidt, Reaktortechnik, Band 2: Anwendungen, ISBN 3 7650 2004 4

T 3.90 Module component: Engine Laboratory [T-MACH-105337]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	2

Courses					
ST 2025	2134001	Engine Laboratory	2 SWS	Practical course / 🗣	Wagner
Exams					
ST 2025	76-T-MACH-105337	Engine Laboratory			Koch

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

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

Prerequisites
T-MACH-114122 must not be started.

Additional Information
This course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Engine Laboratory

2134001, SS 2025, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Organizational issues
voraussichtlich 1. vorlesungsfreie Woche im SS 2025. Wird auf der Homepage und in den Vorlesungen bekannt gegeben.
Für eine Teilnahme müssen Sie sich sowohl im Ilias-Kurs als auch in Campus für das Motorenlabor anmelden.

Literature
Versuchsbeschreibungen

T 3.91 Module component: Engine Measurement Techniques [T-MACH-105169]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2134137	Engine measurement techniques	2 SWS	Lecture / 🗣	Bernhardt
Exams					
ST 2025	76-T-MACH-105169	Engine Measurement Techniques			Bernhardt
WT 25/26	76-T-MACH-105169	Engine Measurement Techniques			Koch

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination, Duration: 0,5 hours, no auxiliary means

Prerequisites
none

Recommendations
T-MACH-102194 Combustion Engines I

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Engine measurement techniques

2134137, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature

1. Grohe, H.:Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C

T 3.92 Module component: Engineering Materials for the Energy Transition [T-MACH-109082]

Coordinators: Prof. Dr. Hans Jürgen Seifert
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2193007	Engineering Materials for the Energy Transition	2 SWS	Lecture / 🗣	Seifert, Ziebert
Exams					
ST 2025	76-T-MACH-109082	Engineering Materials for the Energy Transition			Seifert

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam; about 30 minutes

Prerequisites
T-MACH-108688 - Die Energetik von Werkstoffen der Energiewende must not have been started.

T-MACH-112691 – Engineering Materials for the Energy Transition must not have been started.

Recommendations
Knowledge of Materials Science.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Engineering Materials for the Energy Transition

2193007, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
oral examination (about 30 min)

Recommendations: Knowledge of Materials Science

Workload: 120 hours

T 3.93 Module component: Engineering Mechanics II [T-MACH-100283]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2162250	Engineering Mechanics II	3 SWS	Lecture / 🗣	Böhlke, Langhoff
ST 2025	3162010	Engineering Mechanics II (Lecture)	3 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
ST 2025	76-T-MACH-100283	Engineering Mechanics II			Böhlke, Langhoff
ST 2025	76-T-MACH-100283-englisch	Engineering Mechanics II			Böhlke, Langhoff

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

Assessment
written exam, 90 min, graded

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

Modeled Prerequisites
The following conditions have to be fulfilled:

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

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Engineering Mechanics II

2162250, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- 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 of elastic bars

Literature
Vorlesungsskript
Hibbeler, R.C: Technische Mechanik 2 - Festigkeitslehre. Prentice Hall. Pearson Studium 2005.
Gross, D. et al.: Technische Mechanik 2 - Elastostatik. Springer 2006.
Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994.
Parkus, H.: Mechanik der festen Körper. Springer 1988.

V

Engineering Mechanics II (Lecture)

3162010, SS 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- 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 of elastic bars

T 3.94 Module component: Engineering Mechanics III [T-MACH-112906]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Each winter term	1 semesters	1

Courses					
ST 2025	2161203	Engineering Mechanics III	2 SWS	Lecture /	Proppe
Exams					
ST 2025	76-T-MACH-112906	Engineering Mechanics III			Proppe

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

Assessment
Written exam, duration: 180 minutes

Prerequisites
Coursework in *Tutorial Engineering Mechanics III* (T-MACH-112909) must have been passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112909 - Tutorial Engineering Mechanics III must have been passed.

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Engineering Mechanics III

2161203, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
Kinematics: Cartesian, cylindrical and natural coordinates. Time derivatives in moving reference frames, angular velocities of reference frames.

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:
Pure translation, pure rotation, general plain motion. Instantaneous center of rotation, Kinetics, moment of momentum, principle of work and principle of energy conservation for a rotation around a space-fixed axis. Mass moment of inertia, parallel-axis-theorem.Principle of linear momentum and principle of moment of momentum for arbitrary plain motion. Principle of d'Alembert for plain motion. Principles of linear and moment of momentum in integral form. Applications for impact problems.

Organizational issues
Die Lehrveranstaltung TM III (MACH SPO: 2015, MIT SPO: 2016) wird letztmalig im Wintersemester 2023/24 angeboten. Die Lehrinhalte werden zu einem großen Teil ab Wintersemester 2024/25 im Rahmen der TM III (MACH und MIT: SPO 2023) behandelt. Die Vorleistung für Studierende in den alten SPOs (MACH SPO: 2015, MIT SPO: 2016) werden weiterhin in einer angepassten Form angeboten, die zu gegebener Zeit über ILIAS kommuniziert wird.

Für diese Veranstaltung werden online Unterlagen bereitgestellt.

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.

T 3.95 Module component: Engineer's Field of Work [T-MACH-105721]

Coordinators: Prof. Dr. Martin Doppelbauer
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (written)	2 CP	pass/fail	Each summer term	3

Courses					
ST 2025	2114917	Engineer's Field of Work	2 SWS	Lecture / 🗣	Doppelbauer, Geimer
Exams					
ST 2025	76-T-MACH-105721	Engineer's Field of Work			Doppelbauer, Geimer
WT 25/26	76-T-MACH-105721	Engineer's Field of Work			Geimer, Doppelbauer

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written test

Duration: 60 minutes

result: passed / not passed

The lecture notes may be used during the exam

Prerequisites
none

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V **Engineer's Field of Work** — **Lecture (V) On-Site**
2114917, SS 2025, 2 SWS, Language: German, Open in study portal

Content

AFI1: Organization of Companies (Marcus Geimer)
organizational structure, organizational units, managerial structure, organization charts, project organization, relation between superior and staff, board of managing directors, management of the company, supervisory board, advisory board

AFI 2: Project Management (Marcus Geimer)
definition of project, project manager, project team, primary processes, supporting processes

AFI3: Personnel Development (Martin Doppelbauer)
applications, trainee programs, management career, professional career, career paths in companies, individual career planning, tasks of HR, manpower requirements planning, training, training-on-the-job, tools for human resource management, annual personnel talk, objective agreement

AFI4: Scheduling (Marcus Geimer)
Methods for detailed scheduling, network plans, critical path, Gantt-diagram, milestones

AFI5a/b: Development Processes (Martin Doppelbauer)
research, advance development, series development, product marketing, V-model, SPALTEN-model, technical specifications, requirement specifications, clarification, concept, draft, elaboration, validation, verification, documentation, FMEA

AFI6: Standards and Laws (Martin Doppelbauer)
importance of standards, German and international standardization systems, committees, certification

AFI7: Commercial Law (Martin Doppelbauer)
health protection, safety at work, environment protection, product liability, patents

AFI8: Calculation, Financial Statement (Marcus Geimer)
contract award estimate, project costing, unit cost, target costs, cost center accounting, cost recording, hourly rates, asset accounting, profit and loss statement

AFI9: Governance (Marcus Geimer)
principles of governance (accountability, responsibility, transparency, fairness), leadership (technical, commercial), reviews, boards, audits, codetermination, compliance

T 3.96 Module component: Entrepreneurship [T-WIWI-102864]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	1

Courses					
ST 2025	2545001	Entrepreneurship	2 SWS	Lecture /	Terzidis, Dang
WT 25/26	2545001	Entrepreneurship	2 SWS	Lecture /	Malik, Terzidis, Dang
Exams					
ST 2025	7900002	Entrepreneurship			Terzidis
WT 25/26	7900045	Entrepreneurship			Terzidis

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

Assessment
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

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

Prerequisites
None

Recommendations
None

Below you will find excerpts from courses related to this module component:

V Entrepreneurship

2545001, SS 2025, 2 SWS, Language: English, Open in study portal

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

Content
The lecture as a compulsory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are introduced, which relate to the conception and implementation of newly founded companies.

The focus here is on introducing methods for generating innovative business ideas, translating patents into business concepts, and general principles of business modeling and business planning. In particular, approaches such as Lean-Startup and Effectuation as well as concepts for financing young companies are covered.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in the practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:

The students will be introduced to the topic of entrepreneurship. After successful attendance of the course they should have an overview of the sub-areas of entrepreneurship and be able to understand basic concepts of entrepreneurship and apply key concepts.

Workload:

The total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation)

A grade bonus can be earned by successfully participating in a case study as part of the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam dates: tbd

Organizational issues
VL findet jeweils Di, 15:45 - 19:00 an folgenden Terminen statt:

22.04.2025
29.04.2025
06.05.2025
13.05.2025
20.05.2025
27.05.2025
03.06.2025 (inkl. Prep Session)

17.06.2025 (Klausur)

Literature
Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship

Ries, Eric (2011): The Lean Startup

Osterwalder, Alexander (2010): Business Model Generation

Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

V **Entrepreneurship** — **Lecture (V)**
2545001, WS 25/26, 2 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

Content
The lecture as an obligatory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are presented that relate to the conception and implementation of newly founded companies.

The focus here is on the introduction to methods for generating innovative business ideas, for transferring patents into business concepts and general principles of business modelling and business planning. In particular approaches such as Lean Startup and Effectuation as well as concepts for the financing of young enterprises are treated.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:

The studentsare introduced to the topic Entrepreneurship. After successful attendance of the meeting they are to have an overview of the subranges of the Entrepreneurships and be able to understand basic concepts of the Entrepreneurships and apply key concepts.

Workload:

Total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:

The assessment of success takes place in the form of a written examination (60 min.) (according to §4(2), 1 SPO). The grade is the grade of the written exam.

A grade bonus can be earned through successful participation in a case study in the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4.The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam date: tba

Organizational issues
VL findet jeweils Mo, 15:45 - 19:00 an folgenden Terminen statt:
27.10.2025
03.11.2025
10.11.2025
17.11.2025
24.11.2025
01.12.2025
08.12.2025 (inkl. Prep Session)

Literature
Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Füglistaller, Urs, Müller, Christoph and Volery, Thierry (2008): Entrepreneurship

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

Ries, Eric (2011): The Lean Startup.

Osterwalder, Alexander (2010): Business Model Generation.

T 3.97 Module component: Excercises - Fatigue of Welded Components and Structures [T-MACH-109304]

Coordinators: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each winter term	1

Assessment
successful solving of all exercises

Prerequisites
none

Workload
30 hours

T 3.98 Module component: Exercices - Tribology [T-MACH-109303]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	0 CP	pass/fail	Each winter term	1 semesters	1

Courses					
WT 25/26	2181114	Tribology	5 SWS	Lecture / Practice (/	Dienwiebel, Scherge

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

Assessment
successful solving of all exercises

Prerequisites
none

Additional Information
The course is offered in German.

Below you will find excerpts from courses related to this module component:

V **Tribology**
2181114, WS 25/26, 5 SWS, Language: German, Open in study portal
Lecture / Practice (VÜ)
On-Site

Content

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

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

The student can

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

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

T 3.99 Module component: Exercises for Applied Materials Simulation [T-MACH-107671]

Coordinators: Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	3

Courses					
ST 2025	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice (/	Gumbsch
Exams					
ST 2025	76-T-MACH-107671	Exercises for Applied Materials Simulation			Gumbsch, Schulz

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

Assessment
successful solving of all exercises

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

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Applied Materials Simulation

2182614, SS 2025, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Online

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Organizational issues

Die Vorlesung wir nur als Aufzeichnung angeboten!

Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (2182616)!

Weitere Informationen finden Sie in ILIAS.

Kontakt: johannes.schneider@kit.edu

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 3.100 Module component: Exercises for Materials Characterization [T-MACH-107685]

Coordinators: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	4

Courses					
ST 2025	2174586	Materials Characterization	2 SWS	Lecture / 🗣	Gibmeier, Peterlechner
ST 2025	2174988	Tutorials and lab courses for "materials characterization"	1 SWS	Practice / 🗣	Gibmeier, Peterlechner
Exams					
ST 2025	76-T-MACH-107685	Exercises for Materials Characterization			Gibmeier

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

Assessment
Regular attendance

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110945 - Exercises for Materials Characterization must not have been started.

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Materials Characterization

2174586, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The following methods will be introduced within this lecture:

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

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

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

V Tutorials and lab courses for "materials characterization"

2174988, SS 2025, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
s. lecture "materials characterization" (V-No. 2174586)

Organizational issues
Die Termine und der Ort zu den Übungen und Laborbesuche zur Vorlesung Werkstoffanalytik (V-Nr. 2174586) werden in der Vorlesung bekanntgegeben.

The dates and locations of the tutorials and lab courses for the lecture materials characterization (V-No. 2174586) will be announced in one of the first lectures.

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.101 Module component: Exercises for Materials Characterization [T-MACH-110945]

Coordinators: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2173432	Tutorials and Lab Courses for "Materials Characterization"	1 SWS	Practice / 🗣	Gibmeier, Peterlechner
Exams					
WT 25/26	76-T-MACH-110945	Exercises for Materials Characterization			Gibmeier

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Regular attendance

Prerequisites
T-MACH-107685 – Übungen zu Werkstoffanalytik has not been started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-107685 - Exercises for Materials Characterization must not have been started.

Additional Information
The course is offered in English.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Tutorials and Lab Courses for "Materials Characterization"

2173432, WS 25/26, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
s. lecture "materials characterization" (V-No. 2174586)

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.102 Module component: Exercises for Microstructure-Property-Relationships [T-MACH-114408]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2177021	Exercises in Microstructure-Property-Relationships	1 SWS	Practice / 🗣	Kirchlechner, Wagner, Gruber

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

Assessment
Successful participation in a final colloquium

Prerequisites
T-MACH-114407 – Übungen zu Gefüge-Eigenschafts-Beziehungen has not been started

Additional Information
The course is offered in English.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Exercises in Microstructure-Property-Relationships

2177021, WS 25/26, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Exercise course for the lecture Microstructure-Property-Relationships LV Nr. 2177020.

T 3.103 Module component: Exercises for Solid State Reactions and Kinetics of Phase Transformations [T-MACH-107632]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Dr. Christopher Stihl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each winter term	4

Courses					
WT 25/26	2193004	Exercises for Solid State Reactions and Kinetics of Phase Transformations	1 SWS	Practice / 🗣	Gorr, Stihl

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

Assessment
successful processing of exercises

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

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Exercises for Solid State Reactions and Kinetics of Phase Transformations

Practice (Ü) On-Site

2193004, WS 25/26, 1 SWS, Language: German, Open in study portal

Content
1. Fick's laws of diffusion

2. Calculation of diffusion coefficients

3. Diffusion and solidification

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

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

regular attendance: 14 hours

self-study: 46 hours

Literature
Vorlesungsskript;

Lecture notes

T 3.104 Module component: Experimental Dynamics [T-MACH-105514]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	3

Exams			
ST 2025	76-T-MACH-105514	Experimental Dynamics	Fidlin
WT 25/26	76-T-MACH-105514	Experimental Dynamics	Fidlin

Assessment
oral exam, 30 min.

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

Modeled Prerequisites
The following conditions have to be fulfilled:

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

Additional Information
The course is offered in German.

Workload
120 hours

T 3.105 Module component: Experimental Fluid Mechanics [T-MACH-105512]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	2

Courses					
ST 2025	2153530	Experimental Fluid Mechanics	2 SWS	Lecture /	Kriegseis
WT 25/26	2154446	Experimental Fluid Mechanics	2 SWS	Lecture /	Kriegseis
Exams					
ST 2025	76-T-MACH-105512	Experimental Fluid Mechanics			Kriegseis

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

Assessment
oral exam - 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Experimental Fluid Mechanics

2153530, SS 2025, 2 SWS, Language: English, Open in study portal

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

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

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

The lecture covers a selection of the following topics:

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

Literature
Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Spurk, J.H.:Fluid Mechanics, Springer, 1997

V Experimental Fluid Mechanics

2154446, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

The lecture covers a selection of the following topics:

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

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

Diese Lehrveranstaltung findet im WS 25/26 zum letzten Mal statt!

Literature
Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

T 3.106 Module component: Experimental Lab Class in Welding Technology, in Groups [T-MACH-102099]

Coordinators: Dr.-Ing. Stefan Dietrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	4

Courses					
WT 25/26	2173560	Welding Lab Course, in groupes	3 SWS	Practical course / 🗣	Dietrich, Schulze
Exams					
WT 25/26	76-T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups			Dietrich

Legend: 📱 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Work log

Additional Information
The course is offered in German.

The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period via iam-wk-lehre@iam.kit.edu at the IAM – WK. The lab is carried out in the Handwerkskammer Karlsruhe.

If possible, please bring your own work shoes and long, disposable pants and tops, as we will get our hands dirty and be confronted with molten, flying metal.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Welding Lab Course, in groupes

2173560, WS 25/26, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

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

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

requirements:

You need sturdy shoes and long clothes!

workload:

regular attendance: 50 hours
preparation: 70 hours

Organizational issues
Die Anmeldung erfolgt durch den Beitritt in den ILIAS-Kurs.

Die Lehrveranstaltung "Experimentelles schweißtechnisches Praktikum" findet in zwei Gruppen statt:

Gruppe 1: 16.2.26 bis 20.2.26

Gruppe 2: 23.2.26 bis 27.2.26

Wir beginnen jeweils montags um 7:30 Uhr und schließen das Praktikum freitags
gegen ca. 15 Uhr.

Die Gruppeneinteilung findet Ende Januar statt.

Der Veranstaltungsort ist die

Bildungsakademie Handwerkskammer Karlsruhe
Hertzstr. 177
76187 Karlsruhe

Bitte bringen Sie, wenn möglich, ihre eigenen Arbeitsschuhe und lange und entbehrliche Hosen sowie Oberteile mit, da wir uns die Hände schmutzig machen und mit flüssigem, umherfliegendem Metall konfrontiert sein werden. Für die Mittagspause können Sie sich selbst versorgen oder auch in der Mensa der Bildungsakademie essen.

Literature
wird im Praktikum ausgegeben

T 3.107 Module component: Fabrication Processes in Microsystem Technology [T-MACH-102166]

Coordinators: Dr. Klaus Bade
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	1

Courses					
ST 2025	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture / 🗣	Bade
WT 25/26	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture / 🏵	Bade
Exams					
ST 2025	76-T-MACH-102166	Fabrication Processes in Microsystem Technology			Bade

Legend: 🖥 Online, 🏵 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination, 20 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fabrication Processes in Microsystem Technology

2143882, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included

Literature
M. Madou
Fundamentals of Microfabrication
CRC Press, Boca Raton, 1997
W. Menz, J. Mohr, O. Paul
Mikrosystemtechnik für Ingenieure
Dritte Auflage, Wiley-VCH, Weinheim 2005
L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

V Fabrication Processes in Microsystem Technology

2143882, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Literature

M. Madou
Fundamentals of Microfabrication
CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul
Mikrosystemtechnik für Ingenieure
Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

T 3.108 Module component: Failure Analysis [T-MACH-105724]

Coordinators: Prof. Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2182572	Failure Analysis	2 SWS	Lecture / 🗣	Greiner, Schneider
Exams					
ST 2025	76-T-MACH-105724	Failure Analysis			Schneider

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination, ca. 30 min

Prerequisites
The course T-MACH-114610 - Failure Analysis must not have been started.

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

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Failure Analysis

2182572, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

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

regular attendance: 21 hours
self-study: 99 hours

oral exam, duration: ca. 30 minutes
no notes

Literature

1. G. Lange: Systematische Beurteilung technischer Schadensfälle, 6. Auflage, WILEY-VCH Verlag, 2014, ISBN 978-3-527-68316-1, In der KIT-BIB online verfügbar!
2. A. Neidel, et al.: Handbuch Metallschäden -- REM-Atlas und Fallbeispiele zur Ursachenanalyse und Vermeidung, 2. Auflage, Hanser Verlag, 2011, ISBN 978-3-446-42966-6
3. J. Grosch, et al.: Schadenskunde im Maschinenbau: Charakteristische Schadensursachen – Analyse und Aussagen von Schadensfällen, 6. Auflage, Expert-Verlag, 2014, ISBN 978-3-816-93172-0
4. E. Wendler-Kalsch, H. Gräfen: Korrosionsschadenkunde, Springer-Verlag, 1998, ISBN 3-540-63377-4

T 3.109 Module component: Failure of Structural Materials: Deformation and Fracture [T-MACH-102140]

Coordinators: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2181711	Failure of structural materials: deformation and fracture	3 SWS	Lecture / Practice (/ 🗣	Gumbsch, Weygand
Exams					
ST 2025	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture			Weygand, Gumbsch

Legend: 💻 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, mechanics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Failure of structural materials: deformation and fracture

2181711, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

1. Introduction
2. linear elasticity
3. classification of stresses
4. Failure due to plasticity
    - tensile test
    - dislocations
    - hardening mechanisms
    - guidelines for dimensioning
5. composite materials
6. fracture mechanics
    - hypotheses for failure
    - linear elasic fracture mechanics
    - crack resitance
    - experimental measurement of fracture toughness
    - defect measurement
    - crack propagation
    - application of fracture mechanics
    - atomistics of fracture

The student

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

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

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

Organizational issues
Übungstermine werden in der Vorlesung bekannt gegeben!

Die Veranstaltung wird letztmals im Wintersemester 2025/2026 angeboten!

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe

T 3.110 Module component: Failure of Structural Materials: Fatigue and Creep [T-MACH-102139]

Coordinators: Dr. Patric Gruber
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2181715	Failure of Structural Materials: Fatigue and Creep	2 SWS	Lecture / 🗣	Gruber, Gumbsch
Exams					
ST 2025	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep			Gruber, Gumbsch

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, mechanics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Failure of Structural Materials: Fatigue and Creep

2181715, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1 Fatigue
1.1 Introduction
1.2 Lifetime
1.3 Fatigue Mechanisms
1.4 Material Selection
1.5 Notches and Shape Optimization
1.6 Case Studies: ICE-Accidents

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

The student

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

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

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

Organizational issues
Die Veranstaltung wird letztmals im Wintersemester 2025/2026 angeboten!

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene

T 3.111 Module component: Fatigue of Materials [T-MACH-112106]

Coordinators: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2173586	Fatigue of Materials	2 SWS	Lecture / 🗣	Guth
Exams					
ST 2025	76-T-MACH-112106	Fatigue of Materials			Guth
WT 25/26	76-T-MACH-112106	Fatigue of Materials			Guth

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 20 minutes

Prerequisites
none

Recommendations
Basic knowledge in Materials Science will be helpful.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fatigue of Materials

2173586, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction: historical review and some fatigue damage cases
- Cyclic Stress Strain Behaviour
- Crack Initiation
- Crack Propagation
- Lifetime Behaviour under Cyclic Loading
- Fatigue of Notched Components
- Structural Durability
- Fatigue of composites and compound materials

learning objectives:

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

The students can evaluate the cyclic strength behaviour of materials and components both qualitatively and quantitatively and know the procedures for the assessment of single-stage, multistage and stochastic cyclical loadings.

requirements:

none, basic knowledge in Material Science will be helpful

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Ein Manuskript, das auch aktuelle Literaturhinweise enthällt, wird in der Vorlesung verteilt.

T 3.112 Module component: FEM Workshop - Constitutive Laws [T-MACH-105392]

Coordinators: PD Dr.-Ing. Katrin Schulz
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	1

Courses					
ST 2025	2183716	FEM Workshop -- Constitutive Laws	2 SWS	Block /	Schulz, Weygand
WT 25/26	2183716	FEM Workshop -- constitutive laws	2 SWS	Block /	Schulz, Weygand

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

Assessment
solving of a FEM problem

preparation of a report

preparation of a short presentation

Prerequisites
none

Recommendations
Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V FEM Workshop -- Constitutive Laws

2183716, SS 2025, 2 SWS, Language: German, Open in study portal

Block (B)
Blended (On-Site/Online)

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student

- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading

solving of a FEM problem

preparation of a report

preparation of a short presentation

Organizational issues
Blockveranstaltung, Termine werden noch bekannt gegeben!

Anmeldung per Email bis zum 25.04.2025 an katrin.schulz@kit.edu

V **FEM Workshop -- constitutive laws** **Block (B) On-Site**
2183716, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student

- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading

solving of a FEM problem

preparation of a report

preparation of a short presentation

Organizational issues
Blockveranstaltung: Anmeldung bei der Dozentin (katrin.schulz@kit.edu) bis zum 20.10.2025, Termine siehe Aushang!

Literature
Peter Haupt: Continuum Mechanics and Theory of Materials, Springer; ABAQUS Manual; Skript

T 3.113 Module component: Financial Analysis [T-WIWI-102900]

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

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2530205	Financial Analysis	2 SWS	Lecture / 🗣	Luedecke
ST 2025	2530206	Übungen zu Financial Analysis	2 SWS	Practice / 🗣	Luedecke
Exams					
ST 2025	7900075	Financial Analysis			Luedecke
WT 25/26	7900059	Financial Analysis			Ruckes, Luedecke

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
See German version.

Prerequisites
None

Recommendations
Basic knowledge in corporate finance, accounting, and valuation is required.

Below you will find excerpts from courses related to this module component:

V Financial Analysis

2530205, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature

- Alexander, D. and C. Nobes (2017): Financial Accounting – An International Introduction, 6th ed., Pearson.
- Penman, S.H. (2013): Financial Statement Analysis and Security Valuation, 5th ed., McGraw Hill.

T 3.114 Module component: Finite Element Workshop [T-MACH-105417]

Coordinators: Prof. Dr. Claus Mattheck
Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2182731	Finite Element Workshop	2 SWS	Block / 🗣	Tesari, Weygand, Mattheck
Exams					
ST 2025	76-T-MACH-105417	Finite Element Workshop			Mattheck, Gruber, Weygand

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

Assessment
attendance certificate for participation in all course dates

Prerequisites
none

Recommendations
Continuum Mechanics

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Finite Element Workshop

2182731, SS 2025, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
The students will learn the foundations of the FEM stress analysis and the optimization methode 'Zugdreiecke'.

The student can

- perform stress analysis for simple components using the commercial software package ANSYS
- utilise the method of the tensile triangle to optimize the shape of components with respect to stress distribution

Fundamentals of Continuum Mechanics are required.

regular attendance: 22,5 hours

certificate in case of regular attendance

Organizational issues
Der Workshop ist für das Sommersemester 2025 leider bereits ausgebucht.

T 3.115 Module component: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

Coordinators: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189910	Flows and Heat Transfer in Energy Technology	2 SWS	Lecture / 🗣	Cheng
WT 25/26	2189911	Tutorial 'Flows and Heat Transfer in Energy Technology '	1 SWS	Practice / 🗣	Cheng, Mitarbeiter

Legend: 💻 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 20 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Flows and Heat Transfer in Energy Technology

2189910, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the understanding of major processes in fluid dynamics and heat transfer in energy engineering. Through this lecture the students are capable of understanding the important physical processes and the selection of suitable methods for the analysis of the processes. With the discussion of some practical examples, the students can analyze the pressure drop and heat transfer in energy engineering systems.

1. collection of sample applications
2. heat transfer and its application
3. convective fluid dynamics and heat transfer
4. thermal radiation and its application
5. special cases

Literature

- Bahr, H.D., Stephan, K., Wärme- und Stoffübertragung, 3. Auflage Springer Verlag, 1998

T 3.116 Module component: Flows with Chemical Reactions [T-MACH-105422]

Coordinators: apl. Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2153406	Flows with chemical reactions	2 SWS	Lecture /	Class
Exams					
ST 2025	76-T-MACH-105422	Flows with Chemical Reactions			Class

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

Assessment
oral exam, duration 30 minutes

Auxiliary none

Prerequisites
none

Recommendations
Fluid Mechanics (T-MACH-105207)

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

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Flows with chemical reactions

2153406, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
In this lecture, students acquire a solid understanding of fundamental phenomena in reacting flows. They learn how the high temperature sensitivity of chemical reactions leads to significant simplifications in modeling, particularly by concentrating the reaction on thin layers, known as free interfaces. The students are able to understand and apply simplified chemical models, with a focus on the fluid mechanical aspects. They develop the ability to use analytical methods to solve idealized problems and to simplify more complex issues so that efficient numerical methods can be applied. Furthermore, they learn to derive fluid mechanical equations in curvilinear coordinates and apply them to suitable problems. Overall, the students are empowered to formulate simplified models for reactive flows, critically analyze them, and solve them both analytically and numerically.

Literature
Vorlesungsskript

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

T 3.117 Module component: Fluid Mechanics of Turbulent Flows [T-BGU-110841]

Coordinators: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	6 CP	graded	Each term	1 semesters	1

Courses					
ST 2025	6221806	Fluid Mechanics of Turbulent Flows	4 SWS	Lecture / Practice (/	Uhlmann
Exams					
ST 2025	8244110841	Fluid Mechanics of Turbulent Flows			Uhlmann

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

Assessment
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
180 hours

T 3.118 Module component: Fluid Power Systems [T-MACH-102093]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	2

Exams			
ST 2025	76-T-MACH-102093	Fluid Power Systems	Geimer
ST 2025	76-T-MACH-102095	Fluid Power Systems	Geimer

Assessment
The assessment consists of a oral exam taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Additional Information
Learning Objectives:

The student is able to

- apply and evaluate the physical principles of fluid technology,
- name common components and explain how they work,
- demonstrate the advantages and disadvantages of different components,
- dimension components for a given purpose
- and to calculate simple systems.

Contents:

In the area of hydrostatics, the following topics are covered

- Pressurized fluids,
- pumps and motors,
- valves,
- accessories and hydraulic circuits.

In the field of pneumatics, the following topics are covered

- Compressors,
- drives,
- valves and control systems.

Literature:

Lecture notes for the fluid technology lecture, downloadable via the ILIAS learning platform.

Workload
120 hours

T 3.119 Module component: Fluid-Structure-Interaction [T-MACH-105474]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Mark-Patrick Mühlhausen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2154453	Fluid-Structure-Interaction with Python	2 SWS	/	Mühlhausen
Exams					
ST 2025	76-T-MACH-111507	Fluid-Structure-Interaction with Python			Mühlhausen

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

Assessment
oral exam 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fluid-Structure-Interaction with Python

2154453, SS 2025, 2 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

Content
„The lecture provides the basics for the description and modeling of flows, structures and their interaction. In the practical part, the covered methods and procedures are deepened with various exercises and examples with Python and Ansys Fluent.

- Brief introduction to Python and Ansys Fluent
- Basic equations of continuum mechanics
- Smoothing and remeshing algorithms for mesh deformation
- Finite volume and finite element method
- Methods of fluid-structure interaction
- coupling conditions
- Monolithic and partitioned coupling methods
- Coupling algorithms for partitioned methods
- Stability and convergence of coupled systems”

Organizational issues
Die Anmeldung bitte bis zum 23.07.25 an sekretariat@istm.kit.edu schicken.

Literature
wird in der Vorlesung vorgestellt

T 3.120 Module component: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

Coordinators: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2181720	Foundations of nonlinear continuum mechanics	2 SWS	Lecture / 🗣	Kamlah
Exams					
ST 2025	76-T-MACH-105324	Foundations of Nonlinear Continuum Mechanics			Kamlah

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

Assessment
Oral examination, duration approx. 30 minutes

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Foundations of nonlinear continuum mechanics

2181720, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

Qualification: Engineering Mechanics - Advanced Mathematics

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Vorlesungsskript

T 3.121 Module component: Foundry Technology [T-MACH-105157]

Coordinators: Dr.-Ing. Daniel Günther
Dr.-Ing. Steffen Klan

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2174575	Foundry Technology	2 SWS	Lecture /	Klan, Günther

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

Assessment
The assessment is carried out as a written exam of about 1 h.

Prerequisites
none

Recommendations
The lectures Materials Science I and Materials Science II should have been attended in advance.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Foundry Technology

2174575, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Literature
Literaturhinweise werden in der Vorlesung gegeben

Reference to literature, documentation and partial lecture notes given in lecture

T 3.122 Module component: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

Coordinators: Hon.-Prof. Dr. Bernhard Ulrich Kehrwald
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2133108	Fuels and Lubricants for Combustion Engines	2 SWS	Lecture / 🗣	Kehrwald
Exams					
ST 2025	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines			Kehrwald
WT 25/26	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines			Kehrwald

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Prerequisites
none

Additional Information
The course is offered in German.

Below you will find excerpts from courses related to this module component:

V Fuels and Lubricants for Combustion Engines

2133108, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature
Skript

T 3.123 Module component: Functional Ceramics [T-MACH-105179]

Coordinators: Dr. Miriam Botros
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2126784	Functional Ceramics	2 SWS	Lecture /	Botros
Exams					
ST 2025	76-T-MACH-105179	Functional Ceramics			Botros, Hinterstein
WT 25/26	76T-MACH-105179	Functional Ceramics			Botros

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

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

Auxiliary means: none

The re-examination is offered upon agreement.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

T 3.124 Module component: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

Coordinators: Dipl.-Ing. Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	2 CP	graded	Each winter term	2

Courses					
WT 25/26	2113814	Fundamentals for Design of Motor-Vehicles Bodies I	1 SWS	Lecture / 🗣	Knoch
Exams					
ST 2025	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			Bardehle, Knoch
WT 25/26	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I			Knoch

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

Assessment
Oral examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals for Design of Motor-Vehicles Bodies I

2113814, WS 25/26, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technologie

6. Body in white / body production, body surface

Learning Objectives:

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

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Termine und nähere Informationen: siehe ILIAS oder Institutshomepage

Dates and further information will be published on the homepage of the institute

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 3.125 Module component: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

Coordinators: Dipl.-Ing. Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	2 CP	graded	Each summer term	1

Courses					
ST 2025	2114840	Fundamentals for Design of Motor-Vehicles Bodies II	1 SWS	Lecture / 🗣	Knoch
Exams					
ST 2025	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II			Bardehle, Knoch
WT 25/26	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II			Knoch

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

Assessment
Oral examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals for Design of Motor-Vehicles Bodies II

2114840, SS 2025, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Body properties/testing procedures
2. External body-parts
3. Interior trim
4. Compartment air conditioning
5. Electric and electronic features
6. Crash tests
7. Project management aspects, future prospects

Learning Objectives:

The students know that, often the design of seemingly simple detail components can result in the solution of complex problems. They have knowledge in testing procedures of body properties. They have an overview of body parts such as bumpers, window lift mechanism and seats. They understand, as well as, parallel to the normal electrical system, about the electronic side of a motor vehicle. Based on this they are ready to analyze and to judge the relation of these single components. They are also able to contribute competently to complex development tasks by imparted knowledge in project management.

Organizational issues
Voraussichtliche Termine, nähere Informationen und evtl. Änderungen:

siehe Institutshomepage.

Scheduled dates, further Information and possible changes of date:

see homepage of the institute.

Literature

1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 3.126 Module component: Fundamentals in the Development of Commercial Vehicles [T-MACH-111389]

Coordinators: Christof Weber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	see Annotations	2

Courses					
ST 2025	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture / 🗣	Weber
WT 25/26	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture / 🗣	Weber
Exams					
ST 2025	76T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber
WT 25/26	76T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral group examination

Duration: appr. 30 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
Fundamentals in the Development of Commercial Vehicles I, WT

Fundamentals in the Development of Commercial Vehicles II, ST

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals in the Development of Commercial Vehicles II

2114844, SS 2025, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Gear boxes of commercial vehicles
2. Intermediate elements of the drive train
3. Axle systems
4. Front axles and driving dynamics
5. Chassis and axle suspension
6. Braking System
7. Systems
8. Excursion

Learning Objectives:

The students know the advantages and disadvantages of different drives. Furthermore they are familiar with components, such as transfer box, propeller shaft, powered and non-powered frontaxle etc. Beside other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known. Consequently the student are able to analyze and to judge the general concepts as well as to adjust them precisely with the area of application.

Organizational issues
Genaue Termine sowie nähere Informationen und eventuelle Terminänderungen:

siehe Institutshomepage.

Literature
1.HILGERS, M.: Nutzfahrzeugtechnik lernen, Springer Vieweg, ISSN: 2510-1803

2.SCHITTLER, M.; HEINRICH, R.; KERSCHBAUM, W.: Mercedes-Benz Baureihe 500 – neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff, 1996

3.Robert Bosch GmbH (Hrsg.): Bremsanalgen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994

4.RUBI, V.; STRIFLER, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Indiustrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

5.TEUTSCH, R.; CHERUTI, R.; GASSER, R.; PEREIRA, M.; de SOUZA, A.; WEBER, C.: Fuel Efficiency Optimization of Market Specific Truck Applications, Proceedings of the 5th Commercial Vehicle Technology Symposium – CVT 2018

V Fundamentals in the Development of Commercial Vehicles I

Lecture (V)
On-Site

2113812, WS 25/26, 1 SWS, Language: German, Open in study portal

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

Learning Objectives:

The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.

The students are able to develop parts and components. Furthermore they have knowledge about different cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/Passwoerterlias/

Termine und Nähere Informationen: siehe ILIAS oder Institutshomepage

Dates and further information will be published on the homepage of the institute.

Literature

1. Marwitz, H., Zittel, S.: ACTROS -- die neue schwere Lastwagenbaureihe von Mercedes-Benz, ATZ 98, 1996, Nr. 9

2. Alber, P., McKellip, S.: ACTROS -- Optimierte passive Sicherheit, ATZ 98, 1996

3. Morschheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.

T 3.127 Module component: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

Coordinators: Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Dr.-Ing. Heiko Kubach
Hon.-Prof. Dr. Egbert Lox

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2134138	Fundamentals of catalytic exhaust gas aftertreatment	2 SWS	Lecture / 🗣	Lox, Grunwaldt, Deutschmann
Exams					
ST 2025	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment			Lox

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination, Duration approx. 25 min., no auxiliary means

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals of catalytic exhaust gas aftertreatment

2134138, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
Wenn Sie beabsichtigen, an der Vorlesung teilzunehmen, melden Sie sich bitte unter info@ifkm.kit.edu mit dem Betreff "Anmeldung Vorlesung Lox" an. Das hilft uns bei der Planung. Der Dozent hat eine sehr weite Anreise und wir möchten verhindern, dass die Mindestteilnehmerzahl nicht erreicht wird.

T 3.128 Module component: Fundamentals of Combustion Engine Technology [T-MACH-105652]

Coordinators: Dr.-Ing. Sören Bernhardt
Dr.-Ing. Heiko Kubach
Jürgen Pfeil
Dr.-Ing. Olaf Toedter
Dr.-Ing. Uwe Wagner

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each winter term	2

Courses					
WT 25/26	2133123	Fundamentals of Combustion Engine Technology	3 SWS	Lecture / 🗣	Kubach, Wagner, Toedter, Pfeil, Bernhardt
Exams					
ST 2025	76-T-MACH-105652	Fundamentals of Combustion Engine Technology			Kubach, Toedter, Wagner
WT 25/26	76-T-MACH-105652	Fundamentals of Combustion Engine Technology			Kubach
WT 25/26	76-T-MACH-105652(SP)	Fundamentals of Combustion Engine Technology			Kubach

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam, 60 min.

Prerequisites
none

Below you will find excerpts from courses related to this module component:

V Fundamentals of Combustion Engine Technology

2133123, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

T 3.129 Module component: Fundamentals of Combustion I [T-MACH-105213]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2165515	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas, Shrotriya
WT 25/26	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
WT 25/26	3165016	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Maas
WT 25/26	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Bykov
Exams					
ST 2025	76-T-MACH-105213	Fundamentals of Combustion I			Maas
ST 2025	76-T-MACH-105464	Fundamentals of Combustion I			Maas
WT 25/26	76-T-MACH-105213	Fundamentals of Combustion I - german exam			Maas
WT 25/26	76-T-MACH-105464	Fundamentals of Combustion I - english exam			Maas

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

Assessment
Written exam, approx. 3 hours

Prerequisites
T-MACH-114043 and T-MACH-113998 must not have started

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals of Combustion I

2165515, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

Organizational issues
Bei zu wenigen Hörern wird die Lehrveranstaltung mit der englischen Lehrveranstaltung zusammengelegt.

Literature
Vorlesungsskript,

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

V Fundamentals of Combustion I (Tutorial)

2165517, WS 25/26, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Literature

- Vorlesungsskript
- J. Warnatz; U. Maas; R.W. Dibble: Verbrennung, Springer, Heidelberg 1996

V Fundamentals of Combustion I

3165016, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

Literature
Vorlesungsskript,

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 3.130 Module component: Fundamentals of Energy Technology [T-MACH-105220]

Coordinators: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each summer term	1

Courses					
ST 2025	2130927	Fundamentals of Energy Technology	3 SWS	Lecture / 🗣	Cheng, Badea
ST 2025	3190923	Fundamentals of Energy Technology	3 SWS	Lecture / 🗣	Badea
Exams					
ST 2025	76-T-MACH-105220	Fundamentals of Energy Technology			Cheng, Badea
ST 2025	76-T-MACH-105220 Fundamentals of Energy Technology	Fundamentals of Energy Technology			Badea
WT 25/26	76-T-MACH-105220	Fundamentals of Energy Technology			Badea, Cheng

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

Assessment
Written examination, 90 min

Prerequisites
none

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals of Energy Technology

2130927, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy demand and energy situation
- Energy types and energy mix
- Basics. Thermodynamics relevant to the energy sector
- Conventional fossil-fired power plants
- Combined Cycle Power Plants
- Cogeneration
- Nuclear energy
- Regenerative energies: hydropower, wind energy, solar energy, other energy systems
- Energy demand structures. Basics of economic efficiency and calculus. Optimization
- Energy storage
- Transport of energy
- Power generation and environment. Future of the energy industry

V

Fundamentals of Energy Technology

3190923, SS 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy forms
- Thermodynamics relevant to energy industry
- Energy sources: fossil fuels, nuclear energy, renewable sources
- Energy industry in Germany, Europe and worldwide
- Power generation and environment
- Evaluation of energy conversion processes
- Thermal/electrical power plants and processes
- Transport of energy / energy carriers
- Energy storage
- Systems utilizing renewable energy sources
- Basics of economic efficiency and calculus / Optimisation
- Future of the energy industry

T 3.131 Module component: Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Pants [T-MACH-105530]

Coordinators: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2190465	Fundamentals of reactor safety for the operation and dismantling of nuclear power plants	2 SWS	Lecture / 🗣	Sanchez-Espinoza

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam about 30 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fundamentals of reactor safety for the operation and dismantling of nuclear power plants

Lecture (V) On-Site

2190465, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
This lecture describes the fundamentals of reactor safety for both the operation and the decommissioning of nuclear power plants. The first part will be focused on reactor safety issues important for the operation of a NPP:

- Safety fundamentals as defense in depth, multi-barrier concepts
- Operational modes of nuclear power plants
- Main components for heat removal, safety systems of selected NPP designs
- Thermal characterization of the core and plant under normal operation conditions
- Accident analysis in nuclear power plants- initiation, methods of evaluations and safety implications

The second part of this lecture will be devoted to explain the neutron physical, radiation protection and safety aspects to be considered for the safe and economical decommissioning of nuclear power plants:

- Life cycle of a nuclear power plant and main strategies and challenges in the NPP decommissioning
- Physical processes responsible for the activation of reactor components during the operation of a nuclear power plant
- Radioactive waste generation in the core, classification and radiological relevance
- Waste classification, minimization methods and intermediate and final disposal
- Risk analysis and prevention, radiation protection issues and the regulatory framework for decommissioning
- Computational methods for the estimation of nuclei inventories, activation and dose rates of reactor components

Knowledge in energy technology, nuclear power plants, reactor physics, radiation protection is welcomed

Time of attendance: 30 hours

Self-study: 90 hours

Oral examination; duration: about 30 minutes

Organizational issues
Anmeldung über ILIAS

Literature

Bibliography related to the Block Course *"Fundamentals of Reactor Safety for the Operation and Dismantling of NPPs"*

1. **M. Laraia, "Nuclear decommissioning: planning, execution and international experience", Woodhead Publishing (2012).**
2. **"Radiological Characterization of Shut Down Nuclear Reactors for Decommissioning Purposes", IAEA Technical Report Series No. 389**
3. **"Classification of radioactive waste", IAEA Safety Standards No. GSG-1.**
4. **"Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities", IAEA-TECDOC-1602.**
5. **"Planning, Management and Organizational Aspects of the Decommissioning of Nuclear Facilities", IAEA-TECDOC-1702.**
6. **"Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities", IAEA Technical Report Series No. 462.**
7. **"Safe and effective nuclear power plant life cycle management towards decommissioning", IAEA-TECDOC-1305.**
8. **"Radiological Characterisation for Decommissioning of Nuclear Installations", NEA/RWM/WPDD(2013)2.**
9. **"Proceedings of the ICOND16/International Conference on Nuclear Decommissioning", October 2014 (Aachen, Germany).**
10. **M. Cumo, "Experiences and Techniques in the Decommissioning of Old Nuclear Power Plants, Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety", 25 February – 28 March 2002 (Trieste, Italy).**
11. **"Safety considerations in the Transition from Operation to Decommissioning of Nuclear Facilities", IAEA Technical Report Series 36.**
12. **"State of the Art Technology for Decontamination and Dismantling of Nuclear Facilities", IAEA Technical Report Series395.**
13. **"A review of the situation of decommissioning of nuclear installations in Europe", European Commission Report EUR 17622**
14. **"Radiation Protection Ordinance", (*http://www.bfs.de*).**

T 3.132 Module component: Fusion Technology A [T-MACH-105411]

Coordinators: Dr. Sara Perez Martin
Dr. Klaus-Peter Weiss

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2169483	Fusion Technology A	2 SWS	Lecture / Practice (/	Weiss, Perez Martin
WT 25/26	2169484	Exercise Fusion Technology A	2 SWS	Practice /	Weiss, Perez Martin
Exams					
ST 2025	76-T-MACH-105411	Fusion Technology A			Perez Martin, Größle
WT 25/26	76-T-MACH-105411	Fusion Technology A			Weiss, Größle, Perez Martin

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

Assessment
oral exam of about 30 minutes

Prerequisites
T-MACH-113977 must not have been started.

Recommendations
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering,
basic knowledge in fluid mechanics, material sciences and physics

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fusion Technology A

2169483, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
To transfer the basic physical concepts of particle physics, fusion and nuclear fission; this includes fundamental questions such as how: What is a plasma? How can it be ignited? What is the difference between magnetic and inertial fusion? Based on this, aspects of the stability of plasmas, their control and particle transport are discussed. After characterizing the plasma, the "fire" of fusion, the confinement in magnetic fields is sketched, which are built up with the help of magnetic technology. Here, knowledge of superconductivity, production and design of magnets is imparted. A reactor operation with a plasma as energy source requires a continuous operation of a tritium and fuel cycle, which is generated by the fusion reactor itself. Since fusion plasmas require small material densities, vacuum technology plays a central role. Finally, the heat generated in the fusion power plant must be converted into a power plant process and the reaction products removed. The functional basics and the structure of these fusion-typical in-vessel components are presented and the current challenges and the state of the art are demonstrated.

The course describes the essential functional principles of a fusion reactor, beginning with plasma, magnet technology, the tritium and fuel cycle, vacuum technology and the associated material sciences. The physical basics will be taught and the engineering laws of scaling will be demonstrated. Special importance is attached to the understanding of the interfaces between the different subject areas, which essentially determine the engineering technical interpretations. Methods for identifying and evaluating the central parameters will be demonstrated. Based on the acquired perception skills, methods for the design of solution strategies will be taught and technical solutions will be identified, their weak points discussed and evaluated.

Recommendations/Pre-knowledge:

Basic knowledge of fluid mechanics, materials engineering and physics. Knowledge of heat and mass transfer and electrical engineering is helpful.

Presence time: 21 h
Self-study: 90 h

Oral examination:
Duration: approx. 30 minutes, aids: none

Literature
Innerhalb jedes Teilblockes wird eine Literaturliste der jeweiligen Fachliteratur angegeben. Zusätzlich erhalten die Studenten/-innen das Studienmaterial in gedruckter und elektronischer Version.

T 3.133 Module component: Fusion Technology B [T-MACH-105433]

Coordinators: Dr. Sara Perez Martin
Dr. Michael Rieth

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2190492	Fusion Technology B	2 SWS	Lecture /	Perez Martin, Rieth
ST 2025	2190493	Exercise Fusion Technology B	2 SWS	Practice /	Perez Martin, Rieth
Exams					
ST 2025	76-T-MACH-105433	Fusion Technology B			Perez Martin, Rieth
WT 25/26	76-T-MACH-105433	Fusion Technology B			Rieth, Perez Martin

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

Assessment
oral exam of about 30 minutes

Prerequisites
none

Recommendations
attendance of fusion technology A lecture

reliable capability to use fundamental knowledge communicated in the bachelor study in physics, material sciences , electrical engineering and engineering design

Additional Information
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Fusion Technology B

2190492, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Fusion Technology B is a continuation of Fusion Technology A lecture and includes the following topics:

Fusion neutronics, materials science of thermally and neutronically highly loaded components, reactor scaling and safety as well as plasma heating and current drive. The section fusion neutronics develops the basics of fusion neutronics and its calculation methods, the nuclear physical design of a fusion reactor and the corresponding components (blankets, shielding, activation, tritium breeding ratio and dose rate). Since both neutron fluxes and area power density in a fusion power plant are significantly higher than those of other power plants, they require special materials. After an extension of existing material knowledge by fundamentals and methods for the calculation of radiation damage in materials, strategies for the material selection of functional and structural materials are shown and deepened by examples. The arrangement of components close to the plasma in a fusion power plant means changed requirements for system integration and energy conversion; these questions are the subject of the block reactor scaling and safety. In addition to the explanation of the safety objectives, the methods for achieving the objectives and the computational tools required to achieve them are dealt with in particular. To ignite the plasma, extreme temperatures of several million degrees are required. Special plasma heating methods are used for this purpose, such as electron cyclotron resonance heating (ECRH), ion cyclotron resonance heating (ICRH), current drive at the lower hybrid frequency and neutral particle injection. Their basic mode of action, design criteria, transmission options and performance are presented and discussed. In addition, the heating processes can also be used for plasma stabilization. Some considerations and limitations are presented.

The lecture, which runs over 2 semesters, is aimed at students of engineering sciences and physics after the bachelor. The aim is an introduction to the current research and development on fusion and its long-term goal of a promising energy source. After a short insight into fusion physics, the lecture focuses on key technologies for a future fusion reactor. The lecture will be accompanied by exercises at Campus Nord (block event, 2-3 afternoons per topic).

Recommendations/Prerequisites:

Knowledge of physics, heat and mass transfer, and design theory taught in the bachelor's degree. Attendance of the lecture Fusion technology A

Presence time: 21 h
Self-study: 49 h

Oral proof of participation in the exercises
Duration: approx. 25 minutes, aids: none

Literature
Lecture notes

McCracken, Peter Scott, Fusion, The Energy of Universe, Elsevier Academic Press, ISBN: 0-12-481851-X

T 3.134 Module component: Gear Cutting Technology [T-MACH-102148]

Coordinators: Hon.-Prof. Dr. Markus Klaiber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2149655	Gear Technology	2 SWS	Lecture / 🗣	Klaiber

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral Exam (20 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Gear Technology

2149655, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

Learning Outcomes:

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.135 Module component: Global Logistics [T-MACH-105379]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Exams			
ST 2025	76-T-MACH-105379	Global Logistics	Furmans

Assessment
oral exam (approx. 20 min)

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

T 3.136 Module component: Global Production and Logistics - Part 1: Global Production [T-MACH-105158]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2149613	Global Production	2 SWS	Lecture /	Lanza
Exams					
ST 2025	76-T-MACH-110991	Global Production			Lanza

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

Assessment
Written Exam (60 min)

Prerequisites
"T-MACH-108848 - Globale Produktion und Logistik - Teil 1: Globale Produktion" must not be commenced.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Global Production

2149613, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content

The course examines the planning, design and operation of global production networks of manufacturing companies. It gives an overview of the influencing factors and challenges of global production. In-depth knowledge of common methods and procedures for planning, designing and managing global production networks is imparted.

Therefore, the lecture first of all discusses the connections and interdependencies between the business strategy and the production strategy and illustrates necessary tasks for the definition of a production strategy. Methods for site selection, for the site-specific adaptation of product design and production technology as well as for the establishment of new production sites and for the adaptation of existing production networks to changing framework conditions are subsequently taught within the context of the design of the network footprint. With regard to the management of global production networks, the lecture addresses challenges associated with coordination, procurement and order management in global networks.

The lecture is complemented by an exercise that discusses the use of Industry 4.0 applications in the context of global production as well as current trends with regard to the planning, design and management of global production networks. The exercise is not relevant for Mechanical Engineering

The topics include:

- Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
- Framework for planning, designing and managing global production networks
- Production strategies for global production networks
    - From business strategy to production strategy
    - Tasks of the production strategy (product portfolio management, circular economy, planning of production depth, production-related research and development)
- Design of global production networks
    - Basic types of network structures
    - Planning process for the design of the network footprint
    - Adaptation of the network footprint
    - Site selection
    - Location-specific adaptation of production technology and product design
- Management of global production networks
    - Network coordination
    - Procurement process
    - Order management

Exercise contents only for WiWis:

Exercise for Global Production coverring topics with respect to trends in resilience, sustainability and digitalisation in global production networks.

Learning Outcomes:

The students …

- can explain the challenges and enablers of global production networks and evaluate methods for decision support.
- are able to explain factors influencing decision-making in the design and operation of a global production network.
- are able to distinguish between corporate and business unit strategy as well as forms of growth and outsourcing.
- can explain the objectives of production and production network strategies as well as the ideal-typical forms of strategy
- are able to identify ideal-typical network structures of global production networks.
- can apply a network adjustment, taking into account the relevant aspects.
- can systematically analyse, evaluate and select new locations in the global production network.
- are able to apply challenges and solutions for location-specific manufacturing technology and product design.
- can evaluate the suitability of different forms of co-location of R&D and site roles for the sites in a production network.
- are able to explain the role distribution of sites, the management of external suppliers, order processing and demand planning in global production networks.

Workload MACH:

regular attendance: 21 hours
self-study: 99 hours

Workload WiWi:

regular attendance: 26 hours
self-study: 124 hours

Recommendations:

Combination with Strategic Decision-Making in Global Production Network Design: A Seminar on Optimisation and Simulation (76-T-MACH-113372) is recommended.

Literature
Medien
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt

empfohlene Sekundärliteratur:
Abele, E. et al: Handbuch Globale Produktion, Hanser Fachbuchverlag, 2006 (deutsch)

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

recommended secondary literature:
Abele, E. et al: Global Production – A Handbook for Strategy and Implementation, Springer 2008 (english)

T 3.137 Module component: Global Production and Logistics - Part 2: Global Logistics [T-MACH-105159]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2149600	Global Logistics	2 SWS	Lecture / 🗣	Furmans
Exams					
ST 2025	76-T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics / New: Global Logistics			Furmans

Legend: 💻 Online, 🎥 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Global Logistics

2149600, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies
- Inventory management considering lead time and shipping costs

Media:

presentations, black board

Workload:

regular attendance: 21 hours
self-study: 99 hours

Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with apropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Exam:

The exam consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

The main exam is offered every summer semester. A second date for the exam is offered in winter semester only for students that did not pass the main exam.

Literature
Weiterführende Literatur:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

T 3.138 Module component: Handling Characteristics of Motor Vehicles I [T-MACH-105152]

Coordinators: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture / 🗣	Weitz
Exams					
ST 2025	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I			Unrau
WT 25/26	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I			Weitz

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Handling Characteristics of Motor Vehicles I

2113807, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

Learning Objectives:

The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation. Consequently they are ready to analyze the most importent influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

Organizational issues
Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Literature

1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen I

T 3.139 Module component: Handling Characteristics of Motor Vehicles II [T-MACH-105153]

Coordinators: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2114838	Handling Characteristics of Motor Vehicles II	2 SWS	Lecture /	Unrau
Exams					
ST 2025	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II			Unrau
WT 25/26	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II			Weitz

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

Assessment
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Handling Characteristics of Motor Vehicles II

2114838, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
1. Vehicle handling: Bases, steady state cornering, steering input step, single sine, double track switching, slalom, cross-wind behavior, uneven roadway

2. stability behavior: Basics, stability conditions for single vehicles and for vehicles with trailer

Learning Objectives:

The students have an overview of common test methods, with which the handling of vehicles is gauged. They are able to interpret results of different stationary and transient testing methods. Apart from the methods, with which e.g. the driveability in curves or the transient behaviour from vehicles can be registered, also the influences from cross-wind and from uneven roadways on the handling characteristics are well known. They are familiar with the stability behavior from single vehicles and from vehicles with trailer. Consequently they are ready to judge the driving behaviour of vehicles and to change it by specific vehicle modifications.

Organizational issues
Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Literature

1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen II

T 3.140 Module component: Heat and Mass Transfer [T-MACH-105292]

Coordinators: Prof. Dr. Ulrich Maas
Dr.-Ing. Chunkan Yu

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	1

Courses					
ST 2025	3122512	Heat and Mass Transfer	2 SWS	Lecture / 🗣	Maas
WT 25/26	2165512	Heat and mass transfer	2 SWS	Lecture / 🗣	Yu, Maas
WT 25/26	2165513	Heat and Mass Transfer (Tutorial)	2 SWS	Practice / 🗣	Yu, Bykov
Exams					
ST 2025	76-T-MACH-105292	Heat and Mass Transfer			Maas
WT 25/26	76-T-MACH-105292	Heat and Mass Transfer			Maas

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

Assessment
Written exam, approx. 3 h

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Heat and Mass Transfer

3122512, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (ceondensation, evaporation)
- Radiative heat transfer

Organizational issues
Bitte beachten Sie den Aushang.

Literature

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung" , Springer Verlag, 1993
- Incropera, F., DeWitt, F.: "Fundamentals of Heat and Mass Transfer" , John Wiley & Sons, 1996
- Bird, R., Stewart, W., Lightfoot, E.: "Transport Phenomena" , John Wiley & Sons, 1960

V Heat and mass transfer

2165512, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (ceondensation, evaporation)
- Radiative heat transfer

Literature

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung" , Springer Verlag, 1993
- Incropera, F., DeWitt, F.: "Fundamentals of Heat and Mass Transfer" , John Wiley & Sons, 1996
- Bird, R., Stewart, W., Lightfoot, E.: "Transport Phenomena" , John Wiley & Sons, 1960

V **Heat and Mass Transfer (Tutorial)** **Practice (Ü) On-Site**

2165513, WS 25/26, 2 SWS, Language: German, Open in study portal

T 3.141 Module component: Heat Transfer and Cooling at Thermally Highly Loaded Components [T-MACH-113362]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Jonas Schmid

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Exams			
ST 2025	76-T-MACH-113362	Heat Transfer and Cooling at Thermally Highly Loaded Components	Schmid

Assessment
oral exam, approx. 30 min.

Prerequisites
none

Additional Information
The course is offered in German.

Workload:
regular attendance: 30 h
self-study: 90 h

Workload
120 hours

T 3.142 Module component: Heat Transfer in Nuclear Reactors [T-MACH-105529]

Coordinators: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189907	Flow and heat transfer in nuclear reactors	2 SWS	Lecture / 🗣	Cheng

Legend: 💻 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 20 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Flow and heat transfer in nuclear reactors

2189907, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is designed for students of mechanical engineering and other engineering disciplines in their Bachelor or Master studies. The students will understand the most important heat transfer processes and learn the methods for the analysis of flow and heat transfer in nuclear reactors. Students are capable of explaining the thermal-hydraulic processes occurring in nuclear reactors and of selecting suitable models or simulation codes for thermal-hydraulic design and analysis.

1. Reactor types and thermal-hydraulic design criteria
2. Heat transfer processes and modeling
3. Pressure drop calculation
4. Temperature distribution in nuclear reactor
5. Numerical analysis methods for nuclear reactor thermal-hydraulics

Organizational issues
This compact English lecture will be given on February 10 - 12, 2025, 09:00-17:00.

in seminar room of the Institute IATF, Building 07.08, Room 331

Literature

1. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
2. R.T. Lahey, F.J. Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, 2nd edition, ANS, La Grande Park, Illinois, USA, 1993

T 3.143 Module component: Heatpumps [T-MACH-105430]

Coordinators: Prof. Dr. Ulrich Maas
Dr. Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2166534	Heatpumps	2 SWS	Lecture / 🗣	Wirbser
WT 25/26	2166534	Heatpumps	2 SWS	Lecture / 🗣	Wirbser
Exams					
ST 2025	76-T-MACH-105430	Heatpumps			Maas, Wirbser
WT 25/26	76-T-MACH-105430	Heatpumps			Maas, Wirbser

Legend: 💻 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam (20 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Heatpumps

2166534, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

Literature
Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

V Heatpumps

2166534, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

Literature
Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

T 3.144 Module component: High Performance Computing [T-MACH-105398]

Coordinators: Prof. Dr. Britta Nestler
Dr.-Ing. Michael Selzer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each winter term	3

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

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, physics and materials science
regular participation in the additionally offered computer exercises

Workload
150 hours

T 3.145 Module component: High Performance Powder Metallurgy Materials [T-MACH-102157]

Coordinators: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2126749	Advanced powder metals	2 SWS	Lecture /	Schell
Exams					
ST 2025	76-T-MACH-102157	High Performance Powder Metallurgy Materials			Schell
WT 25/26	76-T-MACH-102157	High Performance Powder Metallurgy Materials			Schell

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

Assessment
oral exam, 20- 30 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Advanced powder metals

2126749, SS 2025, 2 SWS, Language: German, Open in study portal

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

Literature

- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T 3.146 Module component: High Temperature Materials [T-MACH-105459]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Exams			
ST 2025	76-T-MACH-105459	High Temperature Materials	Heilmaier
WT 25/26	76-T-MACH-105459	High Temperature Materials	Heilmaier

Assessment
Oral exam, about 25 minutes

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

T 3.147 Module component: Holistic Approach of Managing Power Plant Operation under Uncertainty and Volatility [T-MACH-112238]

Coordinators: Dr. Marcus Seidl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	1

Courses					
WT 25/26	2189405	Holistic approach of managing power plant operation under uncertainty and volatility	2 SWS	Lecture /	Seidl
Exams					
WT 25/26	76-T-MACH-112238	Holistic approach of managing power plant operation under uncertainty and volatility			Seidl

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

Assessment
oral exam of about 30 minutes

Prerequisites
none

Additional Information
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Holistic approach of managing power plant operation under uncertainty and volatility

Lecture (V) Online

2189405, WS 25/26, 2 SWS, Language: English, Open in study portal

Content

Main Contents:

The structure ofelectricity markets

Requirements from network operators

The basics of commodity markets

The impact of regulation on power plant operation

The role of behavioral economics in power plant decision making

Integration of renewable energy sources into the electricity market

Calibration of power plant operation and maintenance to market requirements

Asset management for power plant fleets

Applying financial engineering to optimize asset utilization

Day-to-day decision making for power plant operation

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

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

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

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

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

Oral exam of about 25 min.

Literature

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

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

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

T 3.148 Module component: Homework 'Basics of Finite Elements' [T-BGU-109908]

Coordinators: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	1 CP	pass/fail	Each winter term	1 semesters	1

Courses					
WT 25/26	6215901	Basics of Finite Elements	2 SWS	Lecture / 🗣	Franke
WT 25/26	6215902	Exercises to Basics of Finite Elements	2 SWS	Practice / 🗣	Zähringer

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
processing of three exercise sheets

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
30 hours

T 3.149 Module component: Human Factors Engineering I (Workplace Design) [T-MACH-114175]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2109031	Human Factors Engineering I (Workplace Design	2 SWS	Lecture / 🗣	Deml
Exams					
WT 25/26	76-T-MACH-114175	Human Factors Engineering I (Workplace Design)			Deml

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam, duration 60 minutes

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Human Factors Engineering I (Workplace Design

2109031, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The module Human Factors Engineering I (Workplace Design) provides basic knowledge and skills in the field of ergonomics and workplace design. Students learn how to design workplaces in a way that promotes the health, safety and performance of employees.

Contents of the module include:

– Introduction to human factors and their relevance to workplace design

– Fundamentals of ergonomics and human interactions with technologies

– Methods for evaluating workplaces and their design

– Analysis of work processes and identification of potential for improvement

– Development of prototypes for ergonomic workplace solutions

Through practical exercises and project work, students have the opportunity to apply their knowledge and solve real-life problems. The aim is to improve quality and efficiency in the workplace and at the same time increase employee satisfaction.

Organizational issues
Die Veranstaltung "Human Factors Engineering I " findet in der ersten Hälfte des Semesters am Mittwoch und Donnerstag bis zum 11.12.2025 statt.
Ab dem 17.12.2025 findet die Veranstaltung "Human Factors Engineering II" am Mittwoch und Donnerstag statt.

The course "Human Factors Engineering I" takes place during the first half of the semester on Wednesdays and Thursdays until December 11, 2025.
Starting from December 17, 2025, the course "Human Factors Engineering II" will be held on Wednesdays and Thursdays.

T 3.150 Module component: Human Factors Engineering II (Organizational Design) [T-MACH-114176]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2109032	Human Factors Engineering II (Organizational Design)	2 SWS	Lecture / 🗣	Deml
Exams					
WT 25/26	76-T-MACH-114176	Human Factors Engineering II (Organizational Design)			Deml

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam, 60 minutes

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Human Factors Engineering II (Organizational Design)

2109032, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
In the Human Factors Engineering II (Organizational Design) module, students acquire in-depth knowledge of the design and optimization of organizational structures. The module focuses on the following topics:

– Fundamentals of organizational design - Analysis of the relationship between people and organizations.

– Teams and Team Dynamics - Examining the factors that influence team performance.

– Communication systems - importance of effective communication within organizations.

– Decision-making - strategies to support decision-making processes in groups.

– Workplace design - application of ergonomic principles to organizational processes.

Through practical case studies and projects, students expand their ability to systematically identify problems in the field of human factors engineering and develop solutions. The module promotes the ability to analyze complex social and technical systems and improves the integration of people into the organizational context.

Organizational issues
Die Veranstaltung "Human Factors Engineering I " findet in der ersten Hälfte des Semesters am Mittwoch und Donnerstag bis zum 11.12.2025 statt.
Ab dem 17.12.2025 findet die Veranstaltung "Human Factors Engineering II" am Mittwoch und Donnerstag statt.

The course "Human Factors Engineering I" takes place during the first half of the semester on Wednesdays and Thursdays until December 11, 2025.
Starting from December 17, 2025, the course "Human Factors Engineering II" will be held on Wednesdays and Thursdays.

T 3.151 Module component: Human-Machine-Interaction [T-INFO-101266]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	3

Courses					
ST 2025	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2025	7500048	Human-Computer-Interaction			Beigl
WT 25/26	7500076	Human-Computer-Interaction			Beigl

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-INFO-106257 - Human-Machine-Interaction Pass must have been passed.

T 3.152 Module component: Human-Machine-Interaction Pass [T-INFO-106257]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2400095	Human-Computer-Interaction	1 SWS	Practice /	Beigl, Lee
ST 2025	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2025	7500121	Human-Computer-Interaction Pass			Beigl

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Exercise sheets must be handed in regularly to pass the course. The specific details will be announced in the lecture.

Prerequisites
None.

Additional Information
Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

T 3.153 Module component: Hybrid and Electric Vehicles [T-ETIT-100784]

Coordinators: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture /	Doppelbauer
WT 25/26	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice /	Doppelbauer
Exams					
ST 2025	7306321	Hybrid and Electric Vehicles			Doppelbauer
WT 25/26	7306321	Hybrid and Electric Vehicles			Doppelbauer

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

Prerequisites
none

T 3.154 Module component: Hydraulic Fluid Machinery I [T-MACH-114616]

Coordinators: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Assessment
Oral examination, duration approx. 20 min.

Prerequisites
T-MACH-105326 must not be started.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.155 Module component: Hydraulic Fluid Machinery II [T-MACH-114617]

Coordinators: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Assessment
Oral examination, duration approx. 20 min.

Prerequisites
T-MACH-105327 must not be started.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.156 Module component: Hydrogen as Energy Carrier [T-CHEMBIO-112317]

Coordinators: Prof. Dr. Helmut Ehrenberg
Organisation: KIT Department of Chemistry and Biosciences
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Each winter term	1 semesters	1

Assessment
Oral exam, about 25 minutes

Workload
120 hours

T 3.157 Module component: Hydrogen in Materials – Exercises and Lab Course [T-MACH-112159]

Coordinators: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	4 CP	pass/fail	Each summer term	1 semesters	3

Courses					
ST 2025	2173584	Hydrogen in Materials – Exercises and Lab Course	2 SWS	Practice / 🗣	Wagner
Exams					
ST 2025	76-T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course			Wagner

Legend: 🖳 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Regular participation and participating in lab course, protocol included.

Prerequisites
T-MACH-112942 - Hydrogen in Materials - Exercises and lab course must not have started.

Recommendations
Participation is only possible parallel to the lecture.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Hydrogen in Materials – Exercises and Lab Course

2173584, SS 2025, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
In this exercise with lab course the contents of the lecture “Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement” are deepened. The students know the differences in thermodynamics and kinetics of the hydrogen interaction with storage materials and construction materials. The students can describe the hydrogen interaction with microstructural defects in materials, and they know the resulting effects on the materials’ mechanical integrity. Based on this, the students can express the requirements of the respective materials classes and transfer them to engineering applications.

Utilizing proper experimental setups, the students can measure hydrogen induced stresses in materials as well as the hydrogens' diffusivity and its chemical potential. From the measurement data, the students can construct metal-hydrogen phase diagrams, and they can qualitatively assess the defect density in the metal.

Organizational issues
Participation is only possible parallel to the lecture.

T 3.158 Module component: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [T-MACH-110923]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2173588	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	2 SWS	Lecture / 🗣	Pundt, Wagner
Exams					
ST 2025	76-T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt
WT 25/26	76-T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt

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

Assessment
Oral exam, about 25 minutes

Prerequisites
T-MACH-108853 - Wasserstoff in Materialien has not been started

T-MACH-110957 - Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung has not been started

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement

2173588, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture teaches physical and chemical basics of hydrogen adsorption and absorption of different materials. It trains the understanding of the specific lattice positions that hydrogen occupies within solids, and its impact on material properties. A thermodynamical approach yields Sievert's law, allowing the students to describe the different solubilities of hydrogen (and other gases) in solid materials. Further thermodynamic data can be obtained using van't Hoff plots of phase transformation pressures. The impact of ternary alloy components, as described by semi-empirical models, will be recognized. The specific mobility of hydrogen in materials will be understood, which divides into classical diffusion and quantum mechanical tunneling processes. The students can describe the interaction of hydrogen with defects in crystal lattices, which is of special interest for properties of nano-scale materials or for the hydrogen embrittlement of steels. Basic embrittlement models can be explained by the students. Actual hydrogen storage systems can be summarized.

learning objectives:

o Hydrogen as energy storage – the hydrogen cycle and safety issues

o methods for hydrogen charging of materials and hydrogen detection

o Hydrogen adsorption at and absorption in different solids, Sievert's law

o interstitial lattice sites and lattice expansion

o Hydrides, van't Hoff plots, phase transitions, M-H binary phase diagrams

o ternary alloy effects

o hydrogen mobility in materials: interstitial diffusion and quantum mechanical tunneling

o interaction of hydrogen with defects

o hydrogen embrittlement of steels, different embrittlement models

o hydrogen in nano-scale systems and new storage materials

Literature
Literaturhinweise und Unterlagen in der Vorlesung

T 3.159 Module component: Hydrogen Technologies [T-MACH-105416]

Coordinators: Olaf Jedicke
Dr. Thomas Jordan

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2170495	Hydrogen Technologies	2 SWS	Lecture / 🗣	Jordan, Jedicke
Exams					
ST 2025	76-T-MACH-105416	Hydrogen Technologies			Jordan, Jedicke

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam, Duration: 90 minutes

Auxiliary: no tools or reference materials may be used during the exam

Prerequisites
none

Recommendations
Fundamentals Thermodynamics

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Hydrogen Technologies

2170495, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The course content is the cross-cutting issue of hydrogen as energy carrier. After successful participation the students may reflect on the fundamental technological basis of an energy system using predominantly hydrogen as an energy carrier or energy storage. Based on this knowledge they may objectify the principle idea of an hydrogen economy.

The students know the fundamental physical and chemical properties of hydrogen and may apply their knowledge on thermodynamics to compare efficiencies of different solutions with hydrogen. They can list, compare and evaluate established and future solutions for production, storage and distribution of hydrogen. They can explain advantages and disadvantages of using hydrogen in conventional combustion processes versus using hydrogen in different fuel cells. In particular the can describe the specific safety aspects related to hydrogen, compare them with other energy vectors and evaluate different measures for risk mitigation.

- Basic concepts
- Production
- Transport and storage
- Application
- Safety aspects

Literature
Ullmann's Encyclopedia of Industrial Chemistry
Hydrogen and Fuel Cells, Ed. S. Stolten, Wiley-VCH, 2010, ISBN 978-3-527-32711-9

T 3.160 Module component: Industrial Aerodynamics [T-MACH-105375]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Stefan Kröber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2153425	Industrial aerodynamics	2 SWS	/	Kröber, Frohnapfel

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

Assessment
oral exam - 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Industrial aerodynamics

2153425, WS 25/26, 2 SWS, Language: German, Open in study portal — **Blended (On-Site/Online)**

Content
This compact lecture deals with flows and aeroacoustics with significance in vehicle development. A special focus is set on the optimization of external vehicle aerodynamics and the presentation of modern industrial wind tunnel technology. The second major thematic block includes both, aeroacoustic basics principles and practical examples of aeroacoustics, especially in the field of automotive technology. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. This lecture focusses on industry relevant methods for analyses and descriptions of forces, aeroacoustic sound fields, flow structures and turbulence. In addition, an overview of numerical methods for industrial applications is given. The integration and interconnection of the methods in the development processes are discussed exemplary.
An excursion to the Mercedes-Benz AG wind tunnel and the research and development centers is planned.

- Introduction
- Aerodynamics of bluff bodies
- Industrial flow measurement techniques and modern wind tunnel technology
- Overview of flow simulation in automotive industry
- Vehicle aerodynamics
- Passenger comfort of roadsters and cabriolets
- Soiling of road vehicles
- Aeroacoustics: basic principles and practical examples of aeroacoustics, especially in the field of automotive technology including aeroacoustic measurement techniques and numerical methods

Students can describe the different properties of aerodynamics and aeroacoustics of vehicles flows. They are qualified to analyze external flows around the vehicles and aeroacoustic sound fields of vehicles.

Organizational issues
Blockvorlesung - Anmeldung erfolgt über das Sekretariat, max. Teilnehmerzahl sind 20 Studierende.

Literature
Vorlesungsskript

T 3.161 Module component: Industrial Circuitry [T-ETIT-100716]

Coordinators: Dr.-Ing. Andreas Liske
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each winter term	1

Exams			
ST 2025	7306327	Industrial Circuitry	Liske

Prerequisites
none

T 3.162 Module component: Information Systems and Supply Chain Management [T-MACH-102128]

Coordinators: Dr.-Ing. Christoph Kilger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	3

Assessment
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
90 hours

T 3.163 Module component: Innovation and Project Management in Rail Vehicle Engineering [T-MACH-113068]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	5

Courses					
ST 2025	2115921	Innovation and Project Management in Rail Vehicle Engineering	2 SWS	Lecture / 🗣	Lang, Cichon
WT 25/26	2115921	Innovation and Project Management in Rail Vehicle Engineering	2 SWS	Lecture / 🗣	Lang, Cichon
Exams					
ST 2025	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Lang, Cichon
WT 25/26	76-T-MACH-106427	Innovation and Project Management in Rail Vehicle Engineering			Lang, Cichon

Legend: 🖥 Online, 💮 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Graded examination:
2/3 of the examination: 20-minute oral examination on the content of the lecture
1/3 of the examination performance of another type: unit accompanying the lecture as part of a 10-minute presentation and a practical application from innovation and project management

Additional Information
The course is offered in German.

Workload
120 hours

T 3.164 Module component: Innovation2Business – Innovation Strategy in the Industrial Corporate Practice [T-MACH-112882]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	4 CP	graded	Each winter term	1 semesters	1

Courses					
WT 25/26	2145182	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	2 SWS	Lecture / 🗣	Albers
Exams					
WT 25/26	76-T-MACH-112882	Innovation2Business – innovation strategy in the industrial corporate practice			Albers

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam based on the lecture handout and materials, duration 90 minutes

Prerequisites
none

Recommendations
None

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Innovation2Business – Innovation Strategy in the Industrial Corporate Practice

Lecture (V) On-Site

2145182, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
lecture block at the Bühl & Herzogenaurach locations with plant tours & fireside evenings + exam-preparatory Q&A.
Exam: written, limited to 30 seats (recommended for: Master's degree; mechanical engineering, industrial engineering, electrical engineering, computer science) → see module manual for details.
In this lecture series, use Schaeffler as an example to learn how global companies continuously transform themselves to grow sustainably and become
maintain a leading position in the global market in the long term through business-oriented innovation.
Together we will go through the most important elements of the innovation and development process and learn about the successes and learnings based on
vivid examples from practice.
Join the fireside evenings with the speakers to discuss the lecture content and beyond in a relaxed atmosphere.
The event is limited to 30 students and is free for you (meals, bus transfers & accommodations).

Organizational issues
Vorlesung findet an Schaeffler-Standorten (Herzogenaurach und Bühl) statt.

Sprache: Unterlagen Englisch, Vortragssprache Englisch

T 3.165 Module component: Innovative Nuclear Systems [T-MACH-105404]

Coordinators: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2130973	Innovative Nuclear Systems	2 SWS	/	Cheng
Exams					
ST 2025	76-T-MACH-105404	Innovative Nuclear Systems			Cheng

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

Assessment
oral exam, 20 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Innovative Nuclear Systems

2130973, SS 2025, 2 SWS, Language: German, Open in study portal **On-Site**

Content
This lecture is addressed to students of mechanical engineering, chemical engineering and physics. Goal of the lecture is the explanation of state-of-the-art development of nuclear systems. Nuclear systems, that are from todays point of view promising will be presented and explained. The main characteristics of such systems and the associated challenges are also part of the lecture.

1. state of the art and development tendencies in nuclear systems
2. advanced concepts in light water cooled systems
3. new developments in fast reactors
4. development tendencies in gas-cooled plants
5. transmutation systems for waste management
6. fusionsystems

Organizational issues
ACHTUNG! (für KIT-Studierende)

Dies sind die korrekten Termine der (regulären) Vorlesung:

Geb. 07.08, SR 331

Mo (14.07.2025), 09:00 bis 17:00
Di (15.07.2025), 09:00 bis 17:00
Mi (16.07.2025), 09:00 bis 17:00

T 3.166 Module component: Innovative Project [T-MACH-109185]

Coordinators: apl. Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Assessment
Students have to deliver pitch-talk supported by slides to convience a commity about their results. A fictive project proposal of 10 to 15 pages.

Prerequisites
none

Recommendations
Participates need to bring there own laptop with Skype installed.

Recommended English profiency äquivalent to:

- IELTS Academic test
  An overall band score of at least 6.5 (with no section lower than 5.5)
- University of Cambridge
  Certificate in Advanced English, CAE (grades A – C)
  Certificate of Proficiency in English, CPE (grades A – C)
- TOEFL Internet-based test, IBT
  A total score of at least 92, with a minimum score of 22 from the writing section

Additional Information
The subject of the project is provided by industry partner or the innovation department from KIT or INP Grenoble. Representatives of industry partner will be addressee for the pitch-talk.

Workload
180 hours

T 3.167 Module component: Integrated Production Planning in the Age of Industry 4.0 [T-MACH-108849]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each summer term	2

Courses					
ST 2025	2150660	Integrated Production Planning in the Age of Industry 4.0	6 SWS	Lecture / Practice (/ 🗣	Lanza
Exams					
ST 2025	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0			Lanza

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral Exam (40 min)

Prerequisites
"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

Additional Information
The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Integrated Production Planning in the Age of Industry 4.0

2150660, SS 2025, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Integrated Production Planning in the age of Industry 4.0 will be taught in the context of this engineering science lecture. In addition to a comprehensive introduction to Industry 4.0, the following topics will be addressed at the beginning of the lecture:

- Basics, history and temporal development of production
- Integrated production planning and integrated digital engineering
- Principles of integrated production systems and further development with Industry 4.0

Building on this, the phases of integrated production planning are taught in accordance with VDI Guideline 5200, whereby special features of parts production and assembly are dealt with in the context of case studies:

- Factory planning system
- Definition of objectives
- Data collection and analysis
- Concept planning (structural development, structural dimensioning and rough layout)
- Detailed planning (PPS, process simulation as a validation tool, planning of conveyor technology and storage systems for linking production and IT systems in the I4.0 factory)
- Preparation and monitoring of implementation
- Start-up and series support

The lecture contents are complemented by numerous current practical examples with a strong Industry 4.0 reference. Aspects of sustainability are anchored in all units and thus basic knowledge of sustainable production planning is taught. Within the exercises the lecture contents are deepened and applied to specific problems and tasks.

Learning Outcomes:
The students …

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.
- know the basic features of sustainable production planning and can apply underlying knowledge.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Organizational issues
Vorlesungstermine dienstags 14.00 Uhr und donnerstags 14.00 Uhr, Übungstermine donnerstags 15.45 Uhr. Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.168 Module component: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

Coordinators: Karl-Hubert Schlichtenmayer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture / 🗣	Schlichtenmayer
Exams					
ST 2025	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars			Schlichtenmayer

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written Exam (60 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Integrative Strategies in Production and Development of High Performance Cars

Lecture (V)
On-Site

2150601, SS 2025, 2 SWS, Language: German, Open in study portal

Content
The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.

The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Learning Outcomes:

The students …

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.169 Module component: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

Coordinators: Dipl.-Ing. Frank Zacharias
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	1

Courses					
ST 2025	2147160	Patents and Patentstrategies in innovative companies	2 SWS	/ 🗣	Zacharias
WT 25/26	2147161	Intellectual Property Rights and Strategies in Industrial Companies	2 SWS	Block / 🗣	Zacharias
Exams					
ST 2025	76-T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies			Zacharias

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

Assessment
oral exam (ca. 20 min)

Prerequisites
none

Recommendations
None

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Patents and Patentstrategies in innovative companies

2147160, SS 2025, 2 SWS, Language: German, Open in study portal — **On-Site**

Content
Attendance at lectures (5 L): 24h

Personal preparation and follow-up of lecture and exercise: 5h

Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

The lecture will describe the requirements to be fulfilled and how protection is obtained for patents, design rights and trademarks, with a particular focus on Germany, Europe and the EU. Active, project-integrated intellectual property management and the use of strategic patenting by technologically oriented companies will also be discussed. Furthermore, the significance of innovations and intellectual property for both business and industry will be demonstrated using practical examples, before going on to consider the international challenges posed by intellectual

property and current trends in the sector. Within the context of licensing and infringement, insight will be provided as to the relevance of communication, professional negotiations and dispute resolution procedures, such as mediation for example. The final item on the agenda will cover those aspects of corporate law that are relevant to intellectual property.

Lecture overview:

1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law

V Intellectual Property Rights and Strategies in Industrial Companies

Block (B)
On-Site

2147161, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
Attendance at lectures (5 L): 24h

Personal preparation and follow-up of lecture and exercise: 5h

Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

The lecture will describe the requirements to be fulfilled and how protection is obtained for patents, design rights and trademarks, with a particular focus on Germany, Europe and the EU. Active, project-integrated intellectual property management and the use of strategic patenting by technologically oriented companies will also be discussed. Furthermore, the significance of innovations and intellectual property for both business and industry will be demonstrated using practical examples, before going on to consider the international challenges posed by intellectual

property and current trends in the sector. Within the context of licensing and infringement, insight will be provided as to the relevance of communication, professional negotiations and dispute resolution procedures, such as mediation for example. The final item on the agenda will cover those aspects of corporate law that are relevant to intellectual property.

Lecture overview:

1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law

Organizational issues
Weitere Informationen siehe IPEK-Homepage.
https://www.ipek.kit.edu/2976_2858.php

T 3.170 Module component: Introduction into Mechatronics [T-MACH-100535]

Coordinators: Andre Orth
apl. Prof. Dr. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2105011	Introduction into Mechatronics	3 SWS	Lecture /	Reischl, Orth
Exams					
ST 2025	76-T-MACH-100535	Introduction into Mechatronics			Reischl

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

Assessment
Oral exam (Duration: 2h)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Introduction into Mechatronics

2105011, WS 25/26, 3 SWS, Language: German, Open in study portal

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

Content
Content:

- Introduction
- Structure of mechatronic systems
- Mathematical treatment of mechatronic systems
- Sensors and actuators
- Measurements: acquisition and interpretation
- Modelling of mechatronic systems
- Control and feedback control systems
- Information processing

Learning objectives:

The student has knowledge about the specific challenge of interdisciplinary collaboration within the framework of mechatronics. He is able to explain the origin, necessity and methodic implementation of interdisciplinary collaboration, to name the main difficulties as well as the special features within the development of mechatronic products from the point of view of development methodic.

The student has fundamental knowledge of modeling mechanical, hydraulically and electrically part systems and about suitable optimization methods.

The student knows the difference in use of the term "system" in mechatronic and mechanical use.

Literature

Heimann, B.; Gerth, W.; Popp, K.: Mechatronik. Leipzig: Hanser, 1998
Isermann, R.: Mechatronische Systeme - Grundlagen. Berlin: Springer, 1999
Roddeck, W.: Einführung in die Mechatronik. Stuttgart: B. G. Teubner, 1997
Töpfer, H.; Kriesel, W.: Funktionseinheiten der Automatisierungstechnik. Berlin: Verlag Technik, 1988
Föllinger, O.: Regelungstechnik. Einführung in die Methoden und ihre Anwendung. Heidelberg: Hüthig, 1994
Bretthauer, G.: Modellierung dynamischer Systeme. Vorlesungsskript. Freiberg: TU Bergakademie, 1997

T 3.171 Module component: Introduction to Bionics [T-MACH-111807]

Coordinators: apl. Prof. Dr. Hendrik Hölscher
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2142151	Introduction to Biomimetics	2 SWS	Lecture / 🗣	Hölscher, Greiner
Exams					
ST 2025	76-T-MACH-102172	Introduction into Biomimetics			Hölscher
WT 25/26	76-T-MACH-102172	Introduction into Biomimetics			Hölscher

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (duration: 60 minutes)

Prerequisites
none

Additional Information
Module component T-MACH-102172 may not be started

Below you will find excerpts from courses related to this module component:

V Introduction to Biomimetics

2142151, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

Basic knowledge in physics and chemistry

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

Organizational issues
Im ILIAS werden Materialien (Videos, Originalliteratur, Übungen) zur Vertiefung zur Verfügung gestellt.

Für die schriftliche Klausur werden zwei Termine angeboten (erste Woche nach Vorlesungsende im Sommersemester und eine Woche vor Vorlesungsbeginn im Wintersemester).

Literature
Folien und Literatur werden in ILIAS zur Verfügung gestellt.

T 3.172 Module component: Introduction to Ceramics [T-MACH-100287]

Coordinators: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2125757	Introduction to Ceramics	3 SWS	Lecture /	Schell, Bucharsky
Exams					
ST 2025	76-T-MACH-100287	Introduction to Ceramics			Schell, Bucharsky, Wagner
WT 25/26	76-T-MACH-100287	Introduction to Ceramics			Pagnan Furlan, Schell, Bucharsky

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

Assessment
The assessment consists of an oral exam (30 min) taking place at a specific date.

The re-examination is offered at a specific date.

Prerequisites
None

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Ceramics

2125757, WS 25/26, 3 SWS, Language: German, Open in study portal

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

Literature

- H. Salmang, H. Scholze, "Keramik", Springer
- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier

T 3.173 Module component: Introduction to Engineering Mechanics I: Statics [T-MACH-108808]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2162238	Introduction to Engineering Mechanics I: Statics and Strength of Materials	2 SWS	Lecture / 🗣	Böhlke, Kehrer
ST 2025	2162239	Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)	1 SWS	Practice / 🗣	Luo
Exams					
ST 2025	76-T-MACH-108808	Introduction to Engineering Mechanics I: Statics			Fidlin

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

Assessment
The assessment consists of a written examination taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at eyery ordinary examination date.

Permitted utilities: none

Prerequisites
None

Additional Information
The course is offered in German.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

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

Lecture (V) On-Site

2162238, SS 2025, 2 SWS, Language: German, Open in study portal

Content
Statics: force · moment · general equilibrium condistions · center of mass · inner force in structure · plane frameworks · theory of adhesion

T 3.174 Module component: Introduction to Engineering Mechanics I: Statics and Strength of Materials [T-MACH-102208]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	2

Courses					
ST 2025	2162238	Introduction to Engineering Mechanics I: Statics and Strength of Materials	2 SWS	Lecture / 🗣	Böhlke, Kehrer
ST 2025	2162239	Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)	1 SWS	Practice / 🗣	Luo
Exams					
ST 2025	76-T-MACH-102208-1	Introduction to Engineering Mechanics I: Statics (75 Min)			Fidlin
ST 2025	76-T-MACH-102208-2	Introduction to Engineering Mechanics I: Statics and Strength of Materials (120 Min)			Fidlin

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of a written examination (120 min) taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at eyery ordinary examination date.

For students of economics the assessement consists of a written examination (Statics - 75 min.)

Permitted utilities: non-programmable calculator

Prerequisites
None

Additional Information
The course is offered in German.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

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

Lecture (V) On-Site

2162238, SS 2025, 2 SWS, Language: German, Open in study portal

Content
Statics: force · moment · general equilibrium condistions · center of mass · inner force in structure · plane frameworks · theory of adhesion

T 3.175 Module component: Introduction to Industrial Production Economics [T-MACH-105388]

Coordinators: Simone Dürrschnabel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Assessment
oral exam (approx. 30 min)
The exam is offered in German only!

Prerequisites
none

Workload
120 hours

T 3.176 Module component: Introduction to Microsystem Technology I [T-MACH-114100]

Coordinators: Dr. Vlad Badilita
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2141861	Introduction to Microsystem Technology I	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
ST 2025	76T-MACH-114100	Introduction to Microsystem Technology I			Badilita, Korvink

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written examination (60 min)

Prerequisites
T-MACH-114035 and T-MACH-105182 must not have started

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Microsystem Technology I

2141861, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Literature
Mikrosystemtechnik für Ingenieure, W. Menz und J. Mohr, VCH Verlagsgesellschaft, Weinheim 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.177 Module component: Introduction to Microsystem Technology II [T-MACH-114101]

Coordinators: Dr. Vlad Badilita
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2142874	Introduction to Microsystem Technology II	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
ST 2025	76T-MACH-114101	Introduction to Microsystem Technology II			Badilita, Korvink

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written examination (60 min)

Prerequisites
T-MACH-114035 and T-MACH-105183 must not have started

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Microsystem Technology II

2142874, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

Organizational issues
Topic: Grundlagen der Mikrosystemtechnik II (MST II) SS 21
Time: Thursdays 14:00 - 15:30
10.91 Redtenbacher-Hörsaal

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

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.178 Module component: Introduction to Multi-Body Dynamics [T-MACH-114755]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each summer term	1

Assessment
written examination, 180 min

Prerequisites
none

Additional Information
The course is offered in English.

Workload
240 hours

T 3.179 Module component: Introduction to Nanotechnology [T-MACH-111814]

Coordinators: apl. Prof. Dr. Hendrik Hölscher
Organisation: KIT Department of Mechanical Engineering
KIT Department of Economics and Management
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2142152	Introduction to Nanotechnology	2 SWS	Lecture / 🗣	Hölscher
Exams					
ST 2025	76-T-MACH-105180	An Introduction into Nanotechnology			Hölscher
WT 25/26	76-T-MACH-105180	Introduction into Nanotechnology			Hölscher, Dienwiebel

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

Assessment
written exam 90 min

Prerequisites
none

Additional Information
T-MACH-111814 may not be started

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Nanotechnology

2142152, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Nanotechnology deals with the fabrication and analysis of nanostructures. The topics of the lecture include

- the most common measurement principles of nanotechnology especially scanning probe methods
- the analysis of physical and chemical properties of surfaces
- interatomic forces and their influence on nanostructures
- methods of micro- and nanofabrication and lithography
- basic models of contact mechanics and nanotribology
- important functional characteristics of nanodevices

Basic knowledge in mathematics and physics is assumed

The successfull attandence of the lecture is controlled by a 30 minutes oral exam.

Organizational issues
Es werden im ILIAS Materialien (Videos, Originalliteratur, Übungen) zum Vertiefung zur Verfügung gestellt.

Für die mündlichen Prüfungen werden zwei Termine angeboten (erste Woche nach Vorlesungsende im Sommersemester und eine Woche vor Vorlesungsbeginn im Wintersemester).

Literature
Alle Folien und Originalliteratur werden auf ILIAS zur Verfügung gestellt.

T 3.180 Module component: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

Coordinators: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2190490	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2025	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation			Dagan
WT 25/26	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation			Dagan

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam of about 30 minutes

Prerequisites
none

Additional Information
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Neutron Cross Section Theory and Nuclear Data Generation

2190490, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V) On-Site

Content
Cross section characterization

Summary of basic cross section theory

Resonance cross section

Doppler broadening

Scattering kernels

Basic of slowing down theory

Unit cell based XS data generation

Cross sections Data libraries

Data Measurements

The students:

- Understand the special importance of cross sections in various domains of natural science (Reactor physics, Material research, Solar radiation etc.)
- Are familiar with the theoretical methods and experimental effort to generate cross sections data.

Regular attendance: 26 h

self study: 94 h

oral exam about 30 min.

Literature

Handbuch von Nuklearen Reaktoren Vol I . Y. Ronen CRC press 1986 (in English)

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

P. Tippler, R. Llewellyn Modern Physics 2008 (in English)

T 3.181 Module component: Introduction to Nonlinear Vibrations [T-MACH-105439]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	7 CP	graded	Each winter term	1

Courses					
WT 25/26	2162247	Introduction to Nonlinear Vibrations	2 SWS	Lecture / 🗣	Fidlin
WT 25/26	2162248	Introduction into the nonlinear vibrations (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Altoé, Kaupp
Exams					
ST 2025	76-T-MACH-105439	Introduction to Nonlinear Vibrations			Fidlin

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 30 min.

Prerequisites
none

Recommendations
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

Additional Information
The course is offered in German.

Workload
210 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Nonlinear Vibrations

2162247, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- dynamic systems
- basic ideas of asymptotic methods
- perturbation methods: Linstedt-Poincare, averaging, multiple scales
- limit cycles
- nonlinear resonance
- basics of the bifurcation analysis, bifurcation diagrams
- types of bifurcations
- discontinuous systems
- dynamic chaos

Literature

- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Nayfeh A.H., Mook D.T. Nonlinear Oscillation. Wiley, 1979.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.
- Fidlin A. Nonlinear Oscillations in Mechanical Engigeering. Springer, 2005.
- Bogoliubov N.N., Mitropolskii Y.A. Asymptotic Methods in the Theory of Nonlinear Oscillations. Gordon and Breach, 1961.
- Nayfeh A.H. Perturbation Methods. Wiley, 1973.
- Sanders J.A., Verhulst F. Averaging methods in nonlinear dynamical systems. Springer-Verlag, 1985.
- Blekhman I.I. Vibrational Mechanics. World Scientific, 2000.
- Moon F.C. Chaotic Vibrations – an Introduction for applied Scientists and Engineers. John Wiley & Sons, 1987.

V **Introduction into the nonlinear vibrations (Tutorial)** **Practice (Ü) On-Site**
2162248, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 3.182 Module component: Introduction to Nuclear Energy [T-MACH-105525]

Coordinators: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189903	Introduction to Nuclear Energy	2 SWS	Lecture / 🗣	Cheng

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 30 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Nuclear Energy

2189903, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the fundamental knowledge of nuclear energy and nuclear reactors. After the lecture the students understand the principle of the usage of nuclear energy, the structure and operation of nuclear power plants and nuclear safety measures. Furthermore, the students are capable of giving technical assessment of the usage of nuclear energy with respect to its safety and sustainability.

T 3.183 Module component: Introduction to Operations Research I and II [T-WIWI-102758]

Coordinators: Prof. Dr. Stefan Nickel
Prof. Dr. Steffen Rebennack
Prof. Dr. Oliver Stein

Organisation: KIT Department of Economics and Management

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

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	see Annotations	2

Courses					
ST 2025	2500008	Computer Exercises on Introduction to Operations Research I	1 SWS	Tutorial (/	Dunke
ST 2025	2550040	Introduction to Operations Research I	2 SWS	Lecture /	Stein
ST 2025	2550043	Tutorials on Introduction to Operations Research I	2 SWS	Tutorial (/	Dunke
WT 25/26	2500030	Computer Exercises on Introduction to Operations Research II	1 SWS	Tutorial (/	Dunke
WT 25/26	2530043	Introduction to Operations Reseasrch II	2 SWS	Lecture /	Stein
WT 25/26	2530044		2 SWS	Tutorial (/	Dunke
Exams					
ST 2025	7900073	Introduction to Operations Research I and II			Nickel

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

Assessment
The assessment of the module is carried out by a written examination (120 minutes) according to Section 4(2), 1 of the examination regulation.
In each term (usually in March and August), one examination is held for both courses.
The overall grade of the module is the grade of the written examination.

Prerequisites
None

Recommendations
Knowledge of Mathematics I and II is recommended, as well as programming knowledge for the software laboratory.
It is strongly recommended to attend the course Introduction to Operations Research I
[2550040] before attending the courseIntroduction to Operations Research II
[2530043].

Workload
270 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Operations Research I

2550040, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Examples for typical OR problems.

Linear Programming: Basic notions, simplex method, duality, special versions of the simplex method (dual simplex method, three phase method), sensitivity analysis, parametric optimization, game theory.

Graphs and Networks: Basic notions of graph theory, shortest paths in networks, project scheduling, maximal and minimal cost flows in networks.

Learning objectives:

The student

- names and describes basic notions of linear programming as well as graphs and networks,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Literature

- Nickel, Rebennack, Stein, Waldmann: Operations Research, 3. Auflage, Springer, 2022
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

V Introduction to Operations Reseasrch II

2530043, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Integer and combinatorial optimization: basic concepts, cutting plane methods, branch-and-bound methods, branch-and-cut methods, heuristic methods.

Nonlinear optimization: basic concepts, optimality conditions, solution methods for convex and nonconvex optimization problems.

Dynamic and stochastic models and methods: Dynamic optimization, Bellman methods, lot-sizing models and dynamic and stochastic models of inventory, queues.

Learning Objectives:

The student

- knows and describes the basic concepts of integer and combinatorial optimization, nonlinear optimization and dynamic optimization,
- knows the methods and models indispensable for a quantitative analysis,
- models and classifies optimization problems and selects appropriate solution procedures to solve simple optimization problems independently,
- validates, illustrates and interprets obtained solutions.

Literature

- Nickel, Rebennack, Stein, Waldmann: Operations Research, 3. Auflage, Springer, 2022
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

T 3.184 Module component: Introduction to the Finite Element Method [T-MACH-105320]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	5

Courses					
ST 2025	2162282	Introduction to the Finite Element Method	2 SWS	Lecture / 🗣	Langhoff, Böhlke
WT 25/26	2162282	Introduction to the Finite Element Method	2 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
ST 2025	76-T-MACH-105320	Introduction to the Finite Element Method			Böhlke, Langhoff

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

Assessment
written exam, 90 min, graded; Additives as announced

Prerequisites
Coursework in *Tutorial Introduction to the Finite Element Method* (T-MACH-110330) must be passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110330 - Tutorial Introduction to the Finite Element Method must have been passed.

Additional Information
The corresponding course is offered in German.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Introduction to the Finite Element Method

2162282, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations

Literature

- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- Jung, M., Langer, U.: Methode der finiten Elemente für Ingenieure: Eine Einführung in die numerischen Grundlagen und Computersimulation, Teubner 2013
- Braess, D.: Finite Elemente -- Theorie, schnelle Löser und Anwendungen in der Elastizitätstheorie, Springer 2013
- Gustafsson, B.: Fundamentals of Scientific Computing, Springer 2011

V

Introduction to the Finite Element Method

2162282, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations

Literature

- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- Jung, M., Langer, U.: Methode der finiten Elemente für Ingenieure: Eine Einführung in die numerischen Grundlagen und Computersimulation, Teubner 2013
- Braess, D.: Finite Elemente -- Theorie, schnelle Löser und Anwendungen in der Elastizitätstheorie, Springer 2013
- Gustafsson, B.: Fundamentals of Scientific Computing, Springer 2011

T 3.185 Module component: Introduction to Theory of Materials [T-MACH-105321]

Coordinators: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2182732	Introduction to Theory of Materials	2 SWS	Lecture / 🗣	Kamlah
Exams					
ST 2025	76-T-MACH-105321	Introduction to Theory of Materials			Kamlah

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination, duration approx. 30 minutes

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Introduction to Theory of Materials

2182732, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

Qualification: Engineering Mechanics; Advanced Mathematics

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
[1] Peter Haupt: Continuum Mechanics and Theory of Materials, Springer
[2] Skript

T 3.186 Module component: IoT Platform for Engineering [T-MACH-106743]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	2

Courses					
ST 2025	2123352	IoT platform for engineering	3 SWS	Project (P / 🗣	Meyer, Maier
WT 25/26	2123352	IoT platform for engineering	3 SWS	Project (P / 🗣	Meyer, Maier
Exams					
ST 2025	76-T-MACH-106743	IoT platform for engineering			Meyer

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Assessment of another type (graded), Group teaching project on Industry 4.0 consisting of: Conception, implementation, accompanying documentation and final presentation.

Below you will find excerpts from courses related to this module component:

V IoT platform for engineering

2123352, SS 2025, 3 SWS, Language: German, Open in study portal

Project (PRO)
On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Organizational issues
Zeit und Ort siehe ILIAS

Literature
Keine / None

V IoT platform for engineering

2123352, WS 25/26, 3 SWS, Language: German/English, Open in study portal

Project (PRO)
On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Organizational issues
Zeit und Ort siehe ILIAS

Literature
Keine / None

T 3.187 Module component: Lab Computer-Aided Methods for Measurement and Control [T-MACH-105341]

Coordinators: Jonas Merkert
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course / 🗣	Stiller
Exams					
WT 25/26	76-T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control			Stiller

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Colloquia

Prerequisites
none

Additional Information
The course is offered in English

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Lab Computer-aided methods for measurement and control

2137306, WS 25/26, 3 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

Content
8 Parallel Courses

Main Topics and Course Content:

- Data acquisition and analysis
- Machine vision: 2D/3D image capture, analysis, and processing
- 3D scene understanding
- Deep learning for object detection
- Control engineering: Model identification, controller design and evaluation
- System integration of machine vision and control

Experiments:

1. Measurement of stochastic signals
2. Computer Vision: Image acquisition and analysis
3. Computer Vision: Image processing
4. Computer Vision: 3D scene understanding
5. Deep Learning: Object detection for an autonomous model car
6. Control of an industrial robot
7. Control of a ball-balancing table: Actuation
8. Control of a ball-balancing table: Control design

A brief description of each experiment can be found on the webpage of the Institute of measurement and control (MRT) (see link below). The lab course consists of 8 experiments, each carried out at a fixed time slot within a week.

Prerequisites:

- Knowledge from the lecture _Fundamentals of Measurement and Control Engineering_ or equivalent
- Basic knowledge of the Python programming language
- Knowledge of image processing (e.g., through the _Machine Vision_ or _Automotive Vision_ lecture or equivalent) is an advantage

Workload: 120 hours

Learning Objectives:

The lab course provides practical knowledge in modern measurement, image processing, and control engineering, with direct relevance to current engineering applications.
Students learn how to extract information from real measurement data, analyze image and sensor data, and control technical systems using standard and AI-based digital methods.
The experiments cover a wide range of topics – from statistical signal processing to image analysis and machine vision, all the way to model-based control of mechatronic systems.
Modern tools such as Python and the PyTorch deep learning framework are used to perform the entire workflow – from data acquisition, through signal and image processing, to implementation in real control systems.

Assessment:

30-minute oral colloquium per group at the start of the experiment.

T 3.188 Module component: Laboratory Exercise in Energy Technology [T-MACH-105331]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Ulrich Maas
Dr.-Ing. Heinrich Wirbser

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	1

Courses					
ST 2025	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov, Schießl
WT 25/26	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course / 🗣	Bauer, Maas, Bykov
Exams					
ST 2025	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser
WT 25/26	76-T-MACH-105331	Laboratory Exercise in Energy Technology			Bauer, Maas, Wirbser, Bykov

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
1 report, approx. 12 pages
Discussion of the documented results with the assistents

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Laboratory Exercise in Energy Technology

2171487, SS 2025, 3 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

Content
ITS:

Online registration within the first two weeks of the lecture period at: http://www.its.kit.edu

Content

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger

ITT:

Registration is online.

Information is available on the institute's website: https://www.itt.kit.edu/21_68.php

Content

- Cooling Tower
- Heatpump
- Plant oil stove

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents
Duration: 30 minutes

no tools or reference materials may be used.

Organizational issues
Information zum Lehrlabor finden Sie auf der Instituts-homepage

V **Laboratory Exercise in Energy Technology** **Practical course (P)**
2171487, WS 25/26, 3 SWS, Language: German/English, Open in study portal **On-Site**

Content
ITS:

Online registration within the first two weeks of the lecture period at: http://www.its.kit.edu

Content

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger

ITT:

Registration is online.

Information is available on the institute's website: https://www.itt.kit.edu/21_68.php

Content

- Cooling Tower
- Heatpump
- Plant oil stove

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents
Duration: 30 minutes

no tools or reference materials may be used

T 3.189 Module component: Laboratory Laser Materials Processing [T-MACH-102154]

Coordinators: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	2

Courses					
ST 2025	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course / 🧩	Schneider, Pfleging
WT 25/26	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course / 🧩	Schneider, Pfleging
Exams					
ST 2025	76-T-MACH-102154	Laboratory Laser Materials Processing			Schneider

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Prerequisites
None

Recommendations
Basic knowledge of physics, chemistry and material science is assumed.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Laboratory "Laser Materials Processing"

2183640, SS 2025, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Organizational issues
Die Praktikumsplätze für das Sommersemester 2025 sind bereits ausgebucht!

Anmeldung für die Nachrückliste per Email an johannes.schneider@kit.edu

Das Praktikum findet semesterbegleitend in Kleingruppen am IAM-ZM (CS) bzw. IAM-AWP (CN) statt!

Die Termine werden zu Beginn des Semesters bekannt gegeben.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press

W.M. Steen: Laser Materials Processing, 2010, Springer

V **Laboratory "Laser Materials Processing"** **Practical course (P)**
2183640, WS 25/26, 3 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Organizational issues
Maximal 16 Teilnehmer/innen!
Es sind nur noch wenige Plätze frei (Stand 31.05.2025)! Registrierung für die Nachrückliste möglich per Email an johannes.schneider@kit.edu
Praktikum findet in Kleingruppen semesterbegleitend (dienstags bzw. mittwochs, halbtägig) auf dem Campus Nord am IAM-AWP (Geb. 681) und auf dem Campus Süd am IAM-CMS (Geb. 30.48) statt!

Termine werden mit den Teilnehmern/innen direkt abgestimmt.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

T 3.190 Module component: Laboratory Mechatronics [T-MACH-105370]

Coordinators: Prof. Dr. Veit Hagenmeyer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	5

Courses					
WT 25/26	2105014	Laboratory mechatronics	3 SWS	Practical course / 🗣	Hagenmeyer, Stiller, Orth

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The laboratory course is offered exclusively as ungraded course work. The assessment consists of a group colloquium at the beginning of the individual specialization phases (Part 1). In addition, a robot control system for a pick-and-place task must be successfully implemented in the group phase (Part 2).

Prerequisites
None

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Laboratory mechatronics

2105014, WS 25/26, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Part I
Control, programming and simulation of robots
CAN-Bus communication
Image processing / machine vision

Part II
Solution of a complex problem in team work

Learning objectives:

The student is able to ...

- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

Nachweis (EN): certificate of successful attendance

Voraussetzung (EN): none

Arbeitsaufwand (EN):

regular attendance: 33.5 h

self-study: 88.5 h

Organizational issues
Das Praktikum ist anmeldepflichtig.

Die Anmeldungsmodalitäten-/fristen werden auf https://www.iai.kit.edu/Pruefungen.php bekannt gegeben.

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 3.191 Module component: Laboratory Solar Energy [T-ETIT-104686]

Coordinators: Dr.-Ing. Klaus Trampert
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2313708	Laboratory Solar Energy	4 SWS	Practical course / 🗣	Trampert, Paetzold, Richards
WT 25/26	2313716	Laboratory Solar Energy	4 SWS	Practical course / 🗣	Richards, Trampert, Paetzold
Exams					
ST 2025	7313708	Laboratory Solar Energy			Trampert, Richards
WT 25/26	7313708	Laboratory Solar Energy			Trampert, Richards

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.192 Module component: Laser in Automotive Engineering [T-MACH-105164]

Coordinators: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2182642	Laser Material Processing	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2025	76-T-MACH-105164	Laser in Automotive Engineering / Laser Material Processing			Schneider

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this module component with Laser Material Processing [T-MACH-112763], Physical Basics of Laser Technology [T-MACH-109084] and Physical Basics of Laser Technology [T-MACH-102102]

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
2. The module component T-MACH-112763 - Laser Material Processing must not have been started.

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Laser Material Processing

2182642, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in material processing
- savety aspects

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of Nd:YAG-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

It is not possible, to combine this lecture with the lecture *Physical basics of laser technology* [2181612].

regular attendance: 22,5 hours
self-study: 97,5 hours

oral examination (ca. 30 min)

no tools or reference materials

Organizational issues
Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!

The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature
W. T. Silvast: Laser Fundamentals, 2004, Cambridge University Press

J. Eichler, H.-J. Eichler: Laser - Basics, Advances, Applications, 2018, Springer

P. Poprawe: Tailored Light 1, 2018, Springer

K. F. Renk: Basics of Laser Physics, 2017, Springer

M. W. Sigrist: Laser: Theorie, Typen und Anwendungen, 2018, Springer-Spektrum

H. Hügel, T. Graf: Materialbearbeitung mit Laser, 2022, Springer Vieweg

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

T 3.193 Module component: Laser Material Processing [T-MACH-112763]

Coordinators: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2182642	Laser Material Processing	2 SWS	Lecture / 🗣	Schneider
Exams					
ST 2025	76-T-MACH-112763	Laser Material Processing			Schneider

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this module component with Laser in Automotive Engineering [T-MACH-105164], module component Physical Basics of Laser Technology [T-MACH-109084] and module component Physical Basics of Laser Technology [T-MACH-102102].

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
2. The module component T-MACH-105164 - Laser in Automotive Engineering must not have been started.

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Laser Material Processing

2182642, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in material processing
- savety aspects

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of Nd:YAG-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

It is not possible, to combine this lecture with the lecture *Physical basics of laser technology* [2181612].

regular attendance: 22,5 hours
self-study: 97,5 hours

oral examination (ca. 30 min)

no tools or reference materials

Organizational issues
Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!

The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature
W. T. Silvast: Laser Fundamentals, 2004, Cambridge University Press

J. Eichler, H.-J. Eichler: Laser - Basics, Advances, Applications, 2018, Springer

P. Poprawe: Tailored Light 1, 2018, Springer

K. F. Renk: Basics of Laser Physics, 2017, Springer

M. W. Sigrist: Laser: Theorie, Typen und Anwendungen, 2018, Springer-Spektrum

H. Hügel, T. Graf: Materialbearbeitung mit Laser, 2022, Springer Vieweg

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

T 3.194 Module component: Leadership and Management Development [T-MACH-105231]

Coordinators: Andreas Ploch
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Assessment
oral exam (approx. 20 min)

Prerequisites
It is not possible to combine this module component with module component Leadership and Management Development [T-MACH-112585].

Additional Information
The course is offered in German.

Workload
120 hours

T 3.195 Module component: Liberalised Power Markets [T-WIWI-107043]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	5,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2581998	Liberalised Power Markets	2 SWS	Lecture / 🗣	Fichtner
WT 25/26	2581999	Übungen zu Liberalised Power Markets	2 SWS	Practice / 🗣	Signer, Fichtner, Beranek
Exams					
ST 2025	7900205	Liberalised Power Markets NEW			Fichtner

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

Assessment
The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Recommendations
None

Workload
165 hours

Below you will find excerpts from courses related to this module component:

V **Liberalised Power Markets** — **Lecture (V) On-Site**
2581998, WS 25/26, 2 SWS, Language: English, Open in study portal

Content

1. Power markets in the past, now and in future

2. Designing liberalised power markets

2.1. Unbundling Dimensions of liberalised power markets
2.2. Central dispatch versus markets without central dispatch
2.3. The short-term market model
2.4. The long-term market model
2.5. Market flaws and market failure
2.6. Regulation in liberalised markets

3. The power (sub)markets

3.1 Day-ahead market
3.2 Intraday market
3.3 (Long-term) Forwards and futures markets
3.4 Emission rights market
3.5 Market for ancillary services
3.6 The “market” for renewable energies
3.7 Future market segments

4. Grid operation and congestion management

4.1. Grid operation
4.2. Congestion management

5. Market power

5.1. Defining market power
5.2. Indicators of market power
5.3. Reducing market power

6. Future market structures in the electricity value chain

1. Power markets in the past, now and in future

2. Designing liberalised power markets

2.2. Unbundling Dimensions of liberalised power markets
2.3. Central dispatch versus markets without central dispatch
2.4. The short-term market model
2.5. The long-term market model
2.6. Market flaws and market failure
2.7. Regulation in liberalised markets

3. The power (sub)markets

3.1 Day-ahead market
3.2 Intraday market
3.3 (Long-term) Forwards and futures markets
3.4 Emission rights market
3.5 Market for ancillary services
3.6 The “market” for renewable energies
3.7 Future market segments

4. Grid operation and congestion management

4.1. Grid operation
4.2. Congestion management

5. Market power

5.1. Defining market power
5.2. Indicators of market power
5.3. Reducing market power

6. Future market structures in the electricity value chain

Literature

Weiterführende Literatur:

Power System Economics; Steven Stoft, IEEE Press/Wiley-Interscience Press, 0-471-15040-1

T 3.196 Module component: Lighting Engineering [T-ETIT-100772]

Coordinators: Prof. Dr. Cornelius Neumann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2313739	Lighting Engineering	2 SWS	Lecture / 🗣	Neumann
WT 25/26	2313741	Lighting Engineering (Tutorial to 2313739)	1 SWS	Practice	Neumann
Exams					
ST 2025	7313739	Lighting Engineering			Neumann

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.197 Module component: Lightweight Engineering Design [T-MACH-105221]

Coordinators: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2146190	Lightweight Engineering Design	2 SWS	Lecture / 🗣	Ott
Exams					
ST 2025	76-T-MACH-105221	Lightweight Engineering Design			Ott, Düser, Albers

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination (90 min)

Prerequisites
None

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Lightweight Engineering Design

2146190, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
General aspects of leightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling

Additionally, guest speakers from industry will present lightweight design from an practical point of view.

The students are able to ...

- evaluate the potential of central lightweight strategies and their application in design processes.
- apply different stiffing methods qualitatively and to evaluate their effectiveness.
- evaluate the potential of computer-aided engineering as well as the related limits and influences on manufacturing.
- reflect the basics of lightweight construction from a system view in the context of the product engineering process.

Organizational issues
Vorlesungsfolien können über die eLearning-Plattform ILIAS bezogen werden.

Die Prüfungsart wird gemäß der Prüfungsordnung zu Vorlesungsbeginn angekündigt:

- Schriftliche Prüfung: 90 min Prüfungsdauer
- Mündliche Prüfung: 20 min Prüfungsdauer
- Erlaubte Hilfsmittel: keine

Medien: Beamer

Arbeitsbelastung:

- Präsenzzeit: 21 h
- Selbststudium: 99 h

Lecture slides are available via eLearning-Platform ILIAS.

The type of examination (written or oral) will be announced at the beginning of the lecture:

- written examination: 90 min duration
- oral examination: 20 min duration
- auxiliary means: None

Media: Beamer

Workload:

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

Literature
Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007

Wiedemann, J.: Leichtbau: Elemente und Konstruktion, Springer Verlag, 2006

Harzheim, L.: Strukturoptimierung. Grundlagen und Anwendungen. Verlag Harri Deutsch, 2008

T 3.198 Module component: Liquid Transportation Fuels [T-CIWVT-111095]

Coordinators: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2231130	Liquid Transportation Fuels	2 SWS	Lecture / 🗣	Rauch
WT 25/26	2231131	Exercises on 2231130 Liquid Transportation Fuels	1 SWS	Practice / 🗣	Rauch
Exams					
ST 2025	7230020	Liquid Transportation Fuels			Rauch

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Learning Control is an oral examination with a duration of about 20 minutes.

Prerequisites
None

T 3.199 Module component: Localization of Mobile Agents [T-INFO-101377]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	24613	Localization of Mobile Agents	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
ST 2025	7500482	Localization of Mobile Agents			Hanebeck
WT 25/26	7500583	Localization of Mobile Agents			Hanebeck

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment takes the form of an oral examination, usually lasting 15 minutes in accordance with Section 4 (2) No. 2 of the SPO.

It will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the performance assessment

- in the form of an oral examination in accordance with § 4 Para. 2 No. 2 SPO **or**
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

will take place.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-INFO-114169 - Localization of Mobile Agents Pass must have been started.

Recommendations
Basic knowledge of linear algebra and stochastics is helpful.

Below you will find excerpts from courses related to this module component:

V Localization of Mobile Agents

24613, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This module provides a systematic introduction to the topic of localization methods. To facilitate entry into the subject, the module is divided into four main topics. Dead reckoning treats the instantaneous determination of a vehicle's position from dynamic parameters such as speed or steering angle. Localization with the aid of measurements of known landmarks is part of static localization. In addition to closed solutions for specific measurements (distances and angles), the method of least squares is introduced for the fusion of arbitrary measurements. This also includes nonlinear optimization methods and certifiable global optimization. Dynamic localization deals with the combination of dead reckoning and static localization using the Kalman filter, which has been successfully used in numerous practical applications. General estimator properties are also discussed. The course concludes with simultaneous localization and mapping (SLAM), which allows localization even when the location of landmarks is (partially) unknown. Thereby the association problem is also addressed.

The lecture is accompanied by a purely digital exercise. Here, numerical tasks are presented that can be solved, for example, with a small program, whereby the solution is automatically checked for correctness. The exercise certificate is a prerequisite for the oral exam. Both are offered throughout the year.

Organizational issues
Präsenz-Vorlesung und digitale/online Übung mit ILIAS Tests.

Terminvereinbarung für mündliche Prüfung unter: pruefung-isas@iar.kit.edu

Literature
Grundlegende Kenntnisse der linearen Algebra und Stochastik sind hilfreich.

T 3.200 Module component: Localization of Mobile Agents Pass [T-INFO-114169]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Exams			
ST 2025	7500483	Localization of Mobile Agents - Pass	Hanebeck
WT 25/26	7500584	Localization of Mobile Agents Pass	Hanebeck

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO).

The assessment is carried out in digital form. There are ILIAS tests with individual, randomized tasks that can be solved by hand or with a small numerical program. User input is automatically assessed and there is instant feedback. There is no limit on retakes. All tests must be passed; learning progress is displayed in ILIAS.

Prerequisites
None.

Recommendations
Basic knowledge of linear algebra and stochastics is helpful.

T 3.201 Module component: Logistics and Supply Chain Management [T-WIWI-102870]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2581996	Logistics and Supply Chain Management	2 SWS	Lecture / 🗣	Schultmann, Rosenberg
Exams					
ST 2025	7981996	Logistics and Supply Chain Management			Schultmann

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of an oral (30 minutes) or written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Below you will find excerpts from courses related to this module component:

V Logistics and Supply Chain Management

2581996, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Students are introduced to the methods and tools of logistics and supply chain management. They students learn the key terms and components of supply chains together with key economic trade-offs. In detail, students gain knowledge of decisions in supply chain management, such as facility location, supply chain planning, inventory management, pricing and supply chain cooperation. In this manner, students will gain knowledge in analyzing, designing and steering of decisions in the domain of logistics and supply chain management.

- Introduction: Basic terms and concepts
- Facility location and network optimization
- Supply chain planning I: flexibility
- Supply chain planning II: forecasting
- Inventory management & pricing
- Supply chain coordination I: the Bullwhip-effect
- Supply chain coordination II: double marginalization
- Supply chain risk management

Literature
Wird in der Veranstaltung bekannt gegeben.

T 3.202 Module component: Logistics and Supply Chain Management [T-MACH-110771]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	9 CP	graded	Each summer term	6

Courses					
ST 2025	2118078	Logistics and Supply Chain Management	4 SWS	Lecture / 🗣	Furmans, Alicke
Exams					
ST 2025	76-T-MACH-110771	Logistics and Supply Chain Management			Furmans

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The success control takes place in the form of an examination performance of a different kind. This is composed as follows:

- 50% assessment of a written examination (60 min) during the semester break
- 50% assessment of an oral examination (approx. 20 min) during the semester break

To pass the examination, both examination performances must be passed.

Prerequisites
None

Additional Information
The module component cannot be taken if one of the module components "T-MACH-102089 – Logistics - Organisation, Design and Control of Logistic Systems" and "T-MACH-105181 – Supply Chain Management" have been taken.

The course is offered in English.

Workload
270 hours

Below you will find excerpts from courses related to this module component:

V Logistics and Supply Chain Management

2118078, SS 2025, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
In the lecture "Logistics and Supply Chain Management", comprehensive and well-founded fundamentals of crucial issues in logistics and supply chain management are presented. Furthermore, the interaction of different design elements of supply chains is emphasized. For this purpose, both qualitative and quantitative models are presented and applied. Additionally, methods for mapping and evaluating logistics systems and supply chains are described. The contents of the lecture are deepened in exercises and case studies and comprehension is partially reviewed in case studies. The contents will be illustrated, among other things, on the basis of supply chains in the automotive industry.

Among others, the following topics are covered:

- Inventory Management
- Forecasting
- Bullwhip Effect
- Supply Chain Segmentation and Collaboration
- Key Performance Indicators
- Supply Chain Risk Management
- Production Logistics
- Location Planning
- Route Planning

It is intended to provide an interactive format in which students can also contribute (and work alone or in groups). Since logistics and supply chain management requires working in an international environment and therefore many terms are derived from English, the lecture will be held in English.

Plenary: The plenary sessions take place on Mondays from 09:45 - 13:00 and from 14:00 - 17:15.

Exercises: There are a total of five exercise sessions, which take place on Thursdays from 2:00 p.m. to 3:30 p.m. The scheduling can be found in Ilias from 20 April 2025.
Examination dates: This is a different type of examination. The written exam is scheduled to take place on 8 August 2025 from 8:00 a.m. to 9:00 a.m. The oral exams are scheduled for the two weeks before that. An oral exam lasts 20 minutes.
Contact persons: In the summer semester 2024, the contact persons for organisational matters are Etienne Hoffmann and Alexander Ernst. Please contact us at
log-scm∂ifl.kit.edu

T 3.203 Module component: Machine Dynamics [T-MACH-105210]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2161224	Machine Dynamics	2 SWS	Lecture /	Proppe
ST 2025	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice /	Proppe, Kaupp, Fischer
WT 25/26	2161224	Machine Dynamics	2 SWS	Lecture /	Proppe
Exams					
ST 2025	76-T-MACH-105210	Machine Dynamics			Proppe

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

Assessment
written exam, 180 min.

Prerequisites
none

Additional Information
The course is offered in English.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Machine Dynamics

2161224, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction
2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models)
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing

Literature
Biezeno, Grammel: Technische Dynamik, 2. Aufl., 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

V Machine Dynamics (Tutorial)

2161225, SS 2025, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

V

Machine Dynamics

2161224, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

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

Organizational issues

Für die Vorlesung werden Unterlagen bereitgestellt.

Literature

Biezeno, Grammel: Technische Dynamik, 2. Aufl., 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

T 3.204 Module component: Machine Dynamics II [T-MACH-105224]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
ST 2025	2162220	Machine Dynamics II	2 SWS	Lecture /	Proppe
WT 25/26	2162220	Machine Dynamics II	2 SWS	Lecture /	Proppe
Exams					
ST 2025	76-T-MACH-105224	Machine Dynamics II			Proppe
WT 25/26	76-T-MACH-105224	Machine Dynamics II			Proppe

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

Assessment
oral exam, 20 min.

Prerequisites
none

Recommendations
Machine Dynamics

Additional Information
The course is offered in German/ English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Machine Dynamics II

2162220, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
Online

Content
Students are able to develop and analyze detailed models in machine dynamics that encompass continuum models, fluid structure interaction, and stability analyses.

hydrodynamic bearings

• rotating shafts in hydrodynamic bearings

• belt drives

• virbation of turbine blades

Organizational issues
Für diese Vorlesung werden online Unterlagen bereitgestellt.

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

V Machine Dynamics II

2162220, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

Content
hydrodynamic bearings
• rotating shafts in hydrodynamic bearings
• belt drives
• virbation of turbine blades

Organizational issues
Die Vorlesung wird ausschließlich online angeboten. Für die Vorlesung werden Unterlagen bereitgestellt.

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

T 3.205 Module component: Machine Tools and High-Precision Manufacturing Systems [T-MACH-110962]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each winter term	1

Courses					
WT 25/26	2149910	Machine Tools and High-Precision Manufacturing Systems	6 SWS	Lecture / Practice (/ 🗣	Fleischer
Exams					
ST 2025	76-T-MACH-110962	Machine Tools and High-Precision Manufacturing Systems			Fleischer

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam (40 minutes)

Prerequisites
T-MACH-102158 - Machine Tools and Industrial Handling must not be commenced.
T-MACH-109055 - Machine Tools and Industrial Handling must not be commenced.
T-MACH-110963 - Machine Tools and High-Precision Manufacturing Systems must not be commenced.

Additional Information
The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Machine Tools and High-Precision Manufacturing Systems

2149910, WS 25/26, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The lecture gives an overview of the construction, use and application of machine tools and high-precision manufacturing systems. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools and high-precision manufacturing systems is conveyed. First, the main components of the systems are systematically explained and their design principles as well as the integral system design are discussed. Subsequently, the use and application of machine tools and high-precision manufacturing systems will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0 and artificial intelligence.
Guest lectures from industry round off the lecture with insights into practice.

The individual topics are:

- Structural components of dynamic manufacturing Systems
- Feed axes: High-precision positioning
- Spindles of cutting machine Tools
- Peripheral Equipment
- Machine control unit
- Metrological Evaluation
- Maintenance strategies and condition Monitoring
- Process Monitoring
- Development process for machine tools and high-precision manufacturing Systems
- Machine examples

Learning Outcomes:

The students …

- are able to assess the use and application of machine tools and high-precision manufacturing systems and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of machine tools and high-precision manufacturing systems (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of machine tools and high-precision manufacturing systems.
- are capable of selecting and evaluating machine tools and high-precision manufacturing systems according to technical and economic criteria.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING/TVWL:
regular attendance: 63 hours
self-study: 207 hours

Organizational issues
Vorlesungstermine montags und mittwochs, Übungstermine donnerstags.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

Lectures on Mondays and Wednesdays, tutorial on Thursdays.
The tutorial dates will announced in the first lecture.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

Literature
Medien:
Skript zur Veranstaltung wird über Ilias (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.206 Module component: Machine Vision [T-MACH-105223]

Coordinators: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	8 CP	graded	Each winter term	3

Courses					
WT 25/26	2137308	Machine Vision	4 SWS	Lecture / Practice (/	Lauer, Merkert
Exams					
ST 2025	76-T-MACH-105223	Machine Vision			Stiller, Lauer
WT 25/26	76-T-MACH-105223	Machine Vision			Stiller, Lauer

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

Assessment
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
None

Additional Information
The course is offered in English

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Machine Vision

2137308, WS 25/26, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Lernziele (EN):

Machine vision (or *computer vision*) describes all kind of techniques that can be used to extract information from camera images in an automated way. Considerable improvements of machine vision techniques throughout recent years, e.g. by the advent of deep learning, have caused growing interest in these techniques and enabled applications in various domains, e.g. robotics, autonomous driving, gaming, production control, visual inspection, medicine, surveillance systems, and augmented reality.

The participants should gain an overview over the basic techniques in machine vision and obtain hands-on experience.

Nachweis: written exam, 60 min.

Arbeitsaufwand: 240 hours

Voraussetzungen: none

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt.Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 3.207 Module component: Machines and Processes [T-MACH-105208]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach
Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each term	3

Courses					
ST 2025	3134140	Machines and Processes	4 SWS	Lecture / Practice (/ 🗣	Bauer, Maas, Kubach, Pritz, Bykov
Exams					
ST 2025	76-T-MACH-105208	Machines and Processes			Kubach, Bauer, Pritz
ST 2025	76-T-MACH-105208e	Machines and Processes			Kubach, Bauer, Pritz
WT 25/26	76-T-MACH-105208e-NEW	Machines and Processes, new Version as of WS 23/24 (exam in English language)			Kubach, Bauer, Koch, Pritz
WT 25/26	76-T-MACH-105208-NEU	Machines and Processes, new Version as of WS 23/24 (Exam in German Language)			Bauer, Koch, Pritz

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (duration: 120 min)

Prerequisites
Taking part at the exam is possible only when lab course has been successfully completed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105232 - Machines and Processes, Prerequisite must have been passed.

Workload
210 hours

T 3.208 Module component: Machines and Processes, Prerequisite [T-MACH-105232]

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

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each term	1

Courses					
ST 2025	2187000	Machines and Processes (Lab Course)	1 SWS	Practical course / 🗣	Bauer, Kubach, Pritz
Exams					
ST 2025	76-T-MACH-105232	Machines and Processes, Prerequisite			Kubach, Bauer, Pritz
WT 25/26	76-T-MACH-105232	Machines and Processes, Prerequisite			Kubach, Maas, Bauer, Pritz

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

Assessment
successful completed training course

Prerequisites
none

Below you will find excerpts from courses related to this module component:

V Machines and Processes (Lab Course)

2187000, SS 2025, 1 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content

successful lab course and written exam (2 h)

Taking part at the exam is possible only when lab course has been successfully completed

Lab course and lecture take place in summer and winter semester.

In the SS the lecture is held in English. The lab course is always bilingual.

Media:

slides to download

Documentation of the labcourse

basics of thermodynamics

thermal fluid machines

- steam turbunes
- gas turbines
- combined-cycle plants
- turbines and compressors
- aircraft engines

hydraulic fluid machines

- oerating performance
- characterization
- control
- cavitation
- wind turbines, propellers

internal combustion engines

- characteristic parameters
- engine parts
- kinematics
- engine processes
- emissions

regular attendance: 48 h, self-study: 160 h

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

T 3.209 Module component: Magnet Technology of Fusion Reactors [T-MACH-105434]

Coordinators: Dr. Klaus-Peter Weiss
Dr. Michael Wolf

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2190496	Magnet Technology of Fusion Reactors	2 SWS	Lecture / 🗣	Weiss, Wolf
Exams					
ST 2025	76-T-MACH-105434	Magnet Technology of Fusion Reactors			Weiss
WT 25/26	76-T-MACH-105434	Magnet Technology of Fusion Reactors			Weiss

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination of about 30 minutes

Prerequisites
none

Additional Information
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Magnet Technology of Fusion Reactors

2190496, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
In Greifswald/Germany the fusion experiment Wendelstein 7-X is now in operation to demonstrate the performance of Stellerator-type fusion machines. In south of France the fusion reactor ITER is under construction which will demonstrate the production of energy by fusion. In both machines the plasma inclusion will be ensured by magnets and to produce high magnetic fields in an efficient way, these magnets have to be superconducting. Design, construction and operation of such magnets is a technologic challenge because low temperature (4.5 K) and high currents (typ. 68 kA) are necessary.

The lecture will show basic principles for design and construction of such magnets and includes:

- Introduction with examples to nuclear fusion and to magnetic plasma confinement
- Basics of low temperature and high temperature properties and cryotechnique
- Material testing and critical material properties at low temperatures
- Principles of magnet design, construction and safe magnet operation
- Present status and magnet examples from fusion projects ITER, W7-X and JT-60SA
- Application of high temperature superconductors on fusion and power engineering

The goal of the lecture is to impart the fundamentals of construction of superconducting magnets. Magnet technology is inherently of multidisciplinary character e.g. material properties at low temperature, high voltage and high current technique. The use of superconductors is mandatory to reach highest magnetic fields with comparable small losses. Examples of magnets from power application, basic research and fusion reactor construction are discussed.

Lecture Content:

- Basics of nuclear fusion and design aspects of fusion magnets
- Superconductors - basics and stability
- Low temperature cryogenic aspects
- Low temperature and high temperature superconductors
- Cryogenic material testing and properties of fusion materials at low temperatures
- Quench and high voltage aspects for magnets
- Status and magnets of fusion machines ITER, W7-X, JT-60SA & future DEMO
- Impact of high temperature superconductors on fusion and power engineering

Educational objective: The students know:

- Magnetic plasma confinement principles in connection with fusion machine
- Examples and basic properties of different superconductors
- Basics of formation of superconducting cables and magnet construction
- Generation of low temperature, cryostat construction
- Basics of magnet design and magnet safety
- Material testing and material properties at low temperatures
- High-temperature superconductor use in magnet construction and power application

Recommendations:

Knowledge in energy technology, power plants, material testing is welcomed

- Time of attendance: 2 SWS, Other: excursion, etc. 5 hours
- Self-study: preparation and postprocessing LV (course): 1 hour / week
- Preparation for the examination: 80 hours per semester

Oral examination of about 30 minutes

T 3.210 Module component: Magnetohydrodynamics [T-MACH-105426]

Coordinators: apl. Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2153429	Magnetohydrodynamics	2 SWS	Lecture / 🗣	Bühler
Exams					
ST 2025	76-T-MACH-105426	Magnetohydrodynamics			Bühler

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral

Duration: 30 minutes

No auxiliary means

Prerequisites
T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) must not be startet or completed.

T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

Recommendations
Fluid Mechanics (T-MACH-105207)

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

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Magnetohydrodynamics

2153429, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

Literature
U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer Verlag

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

T 3.211 Module component: Management Accounting 1 [T-WIWI-102800]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2579900	Management Accounting 1	2 SWS	Lecture /	Wouters
ST 2025	2579901	Tutorial Management Accounting 1 (Bachelor)	2 SWS	Practice /	Dickemann
ST 2025	2579902	Tutorial Management Accounting 1 (Master)	2 SWS	Practice /	Dickemann
Exams					
ST 2025	79-2579900-B	Management Accounting 1 (Bachelor)			Wouters
ST 2025	79-2579900-M	Management Accounting 1 (Mastervorzug und Master)			Wouters

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

Assessment
The assessment consists of a written exam (120 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Recommendations
We recommend that you take part in our exercise for the lecture.

Additional Information
The exercise is offered separately for Bachelor's students as well as for students in the Master's transfer and Master's program.

Note for exam registration:

- Bachelor students: 79-2579900-B Management Accounting 1 (Bachelor)
- Students in the Master's transfer and Master's program: 79-2579900-M Management Accounting 1 (Master's transfer and Master)

Below you will find excerpts from courses related to this module component:

V Management Accounting 1

2579900, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

Content
The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA1 are: short-term planning, investment decisions, budgeting and activity-based costing.

We will use international material written in English.

We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).

The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

Learning objectives:

- Students have an understanding of theory and applications of management accounting topics.
- They can use financial information for various purposes in organizations.

Examination:

- The assessment consists of a written exam (120 minutes) at the end of each semester (following § 4 (2) No. 1 of the examination regulation).

Workload:

- The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Publisher: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- In addition, several papers that will be available on ILIAS.

V Tutorial Management Accounting 1 (Bachelor)

Practice (Ü)
On-Site

2579901, SS 2025, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

V Tutorial Management Accounting 1 (Master)

Practice (Ü)
On-Site

2579902, SS 2025, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

T 3.212 Module component: Management and Strategy [T-WIWI-102629]

Coordinators: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2577900	Strategic Management	2 SWS	Lecture / 🗣	Lindstädt
Exams					
ST 2025	7900067	Strategic Management			Lindstädt
WT 25/26	7900199	Strategic Management			Lindstädt

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of a written exam (60 min) taking place at the beginn of the recess period (according to §4 (2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
None

Below you will find excerpts from courses related to this module component:

V Strategic Management

2577900, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Students learn central concepts of strategic management along the ideal-typical strategy process. An overview of fundamental frameworks and models will be provided and an action-oriented integration performance will be achieved through the transfer of theory to practical issues.

Through intensive exposure to real-world case studies, students will be encouraged to learn and apply strategic measures in a targeted manner in the real business world. The course features an action-oriented approach and provides students with a realistic understanding of the possibilities and limitations of rational design approaches.

Content in Keywords:

- Corporate governance and strategic management: concepts, levels, process.
- Strategic analysis: internal and external analysis
- Competitive strategy: formulation, evaluation and selection of strategic action alternatives at business unit level
- Strategic interaction and strategic commitment
- Corporate strategy: diversification strategy, M&A and management of the corporate portfolio
- Implementation of strategies in companies

Structure:

Lectures in the course are available to students online as recordings, while class dates are reserved for active discussion of real-world case studies.

Learning Objectives:

Upon completion of the course, students will be able to,

- Prepare strategic decisions along the ideal strategic process in a practical setting,
- Identify sources of competitive advantage,
- Explain interrelationships of companies in competition,
- Evaluate the portfolio management of companies,
- To classify actions and decisions of companies strategically,
- Apply knowledge from theoretical frameworks to the analysis of real-life situations.

Recommendations:

None.

Workload:

Total workload for 3.5 credit hours: approximately 105 hours.

Attendance: 30 hours

Self-study: 75 hours

Competence Certificate:

Success is assessed in the form of a written examination (60 minutes) (in accordance with §4(2), 1 SPO) at the beginning of the lecture-free period of the semester. The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be earned by successfully participating in the exercises. If the grade of the exam is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

Literature

- Pidun, U.: *Corporate Strategy: Theory and Practice*. Springer-Gabler, Wiesbaden 2019.
- Lindstädt, H.; Hauser, R.: *Strategische Wirkungsbereiche des Unternehmens*. Gabler, Wiesbaden 2004.
- Grant, R.M.: *Contemporary Strategy Analysis, 10. Aufl., Wiley 2018.*

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

T 3.213 Module component: Materials Characterization [T-MACH-107684]

Coordinators: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	4

Courses					
ST 2025	2174586	Materials Characterization	2 SWS	Lecture / 🗣	Gibmeier, Peterlechner
Exams					
ST 2025	76-T-MACH-107684	Materials Characterization			Gibmeier
WT 25/26	76-T-MACH-107684	Materials Characterization			Gibmeier

Legend: 🖥 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
Successful participation in Übungen zu Werkstoffanalytik is the condition for the admittance to the oral exam in Werkstoffanalytik.

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

T-MACH-110946 – Materials Characterization has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-107685 - Exercises for Materials Characterization must have been passed.
2. The module component T-MACH-110945 - Exercises for Materials Characterization must not have been started.
3. The module component T-MACH-110946 - Materials Characterization must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Materials Characterization

2174586, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The following methods will be introduced within this lecture:

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

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

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.214 Module component: Materials Characterization [T-MACH-110946]

Coordinators: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2173431	Materials Characterization	2 SWS	Lecture / 🗣	Gibmeier, Peterlechner
Exams					
ST 2025	76-T-MACH-110946	Materials Characterization			Gibmeier
WT 25/26	76-T-MACH-110946	Materials Characterization			Gibmeier

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
Successful participation in Exercises for Materials Characterization is the condition for the admittance to the oral exam in Materials Characterization.

T-MACH-107685 – Übungen zu Werkstoffanalytik has not been started.

T-MACH-107684 – Werkstoffanalytik has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110945 - Exercises for Materials Characterization must have been passed.
2. The module component T-MACH-107685 - Exercises for Materials Characterization must not have been started.
3. The module component T-MACH-107684 - Materials Characterization must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Materials Characterization

2173431, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The following methods will be introduced within this lecture:

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

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

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.215 Module component: Materials Modelling: Dislocation Based Plasticity [T-MACH-105369]

Coordinators: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2182740	Materials modelling: dislocation based plasticity	2 SWS	Lecture / 🗣	Weygand
Exams					
ST 2025	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticy			Weygand

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam ca. 30 minutes

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Materials modelling: dislocation based plasticity

2182740, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction
2. elastic fields of dislocations
3. slip, crystallography
4. equations of motion of dislocations
a) fcc
b) bcc
5. interaction between dislocations
6. molecular dynamics
7. discrete dislocation dynamics
8. continuum description of dislocations

The student

- has the basic understanding of the physical basics to describe dislocations and their interaction with point, line and area defects.
- can apply modelling approaches for dislocation based plasticity.
- can explain discrete methods for modelling of microstructural evolution processes.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature

1. D. Hull and D.J. Bacon, Introduction to Dislocations, Oxford Pergamon 1994
2. W. Cai and W. Nix, Imperfections in Crystalline Solids, Cambridge University Press, 2016
3. J.P. Hirth and J. Lothe: Theory of dislocations, New York Wiley 1982. (oder 1968)
4. J. Friedel, Dislocations, Pergamon Oxford 1964.
5. V. Bulatov, W. Cai, Computer Simulations of Dislocations, Oxford University Press 2006
6. A.S. Argon, Strengthening mechanisms in crystal plasticity, Oxford materials.

T 3.216 Module component: Materials of Lightweight Construction [T-MACH-105211]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2174574	Materials of Lightweight Construction	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2025	76-T-MACH-105211	Materials of Lightweight Construction			Liebig
WT 25/26	76-T-MACH-105211	Materials of Lightweight Construction			Liebig

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, × Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
T-MACH-114012 must not have been started.

Recommendations
Materials Science I/II

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Materials of Lightweight Construction

2174574, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Introduction

Constructive, production-orientied and material aspects of lightweight construction

Aluminium-based alloys

Aluminium wrought alloys

Aluminium cast alloys

Magnesium-based alloys

Magnesium wrought alloys

Magnesium cast alloys

Titanium-based alloys

Titanium wrought alloys

Titanium cast alloys

High-strength steels

High-strength structural steels,

Heat-treatable steels, press-hardening and hardenable steels

Composites - mainly PMC

Matrices

Reinforcements

Basic mechanical principles of composites

Hybrid composites

Special materials for lightweight design

Beryllium alloys

Metallic Glasses

Applications

learning objectives:
The students are capable to name different lightweight materials and can describe their composition, properties and fields of application. They can describe the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.
The students can apply basic mechanical models of composites and can depict differences in the mechanical properties depending on composition and structure. The students can describe the basic principle of hybrid material concepts and can judge their advantages in comparison to bulk materials. The students can name special materials for lightweight design and depict differences to conventional materials. The students have the ability to present applications for different lightweight materials and can balance reasons for their use.
requirements:
Werkstoffkunde I/II (recommended)
workload:

The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

Examination:

Oral examination, Duration approx. 25 min

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

T 3.217 Module component: Materials Physics and Metals [T-MACH-100285]

Coordinators: Dr. Patric Gruber
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	12 CP	graded	Each winter term	3

Courses					
ST 2025	2174598	Metals	4 SWS	Lecture / 🗣	Pundt, Wagner
ST 2025	2174599	Exercises in Metals	1 SWS	Practice / 🗣	Wagner
WT 25/26	2177010	Materials Physics	3 SWS	Lecture / 🗣	Gruber
Exams					
ST 2025	76-T-MACH-100285	Materials Physics and Metals			Pundt, Gruber, Wagner
WT 25/26	76-T-MACH-100285	Materials Physics and Metals			Pundt, Gruber
WT 25/26	76-T-MACH-100285-W	Materials Physics and Metals			Pundt, Gruber

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

Assessment
Oral exam, about 45 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
360 hours

Below you will find excerpts from courses related to this module component:

V Metals

2174598, SS 2025, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 42 h

Self-study: 138 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature

D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

G. Gottstein. Physikalische Grundlagen der Materialkunde, Springer 2007

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001

H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005

J. Rösler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008

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

V Exercises in Metals

Practice (Ü)
On-Site

2174599, SS 2025, 1 SWS, Language: German, Open in study portal

Content

Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

Learning objectives:

The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

Requirements:

Lecture and Tutorials on Materials Physics as well as the lecture on Metals

Workload:

Regular attendance: 14 h

Self-study: 16 h

Organizational issues

Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

T 3.218 Module component: Materials Processing Technology [T-MACH-100295]

Coordinators: Dr. Joachim Binder
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2173540	Materials Processing Technology	3 SWS	Lecture / Practice (/	Liebig, Binder
WT 25/26	2173541	Materials Processing Lab Course	1 SWS	Practical course /	Liebig, Binder
Exams					
ST 2025	76-T-MACH-100295	Materials Processing Technology			Liebig, Binder

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

Assessment
Oral exam (lecture + lab course), approx. 25 min, lab course "Materials Processing" has to be finished successfully.

Prerequisites
Lab course "Materials Processing" has to be passed successfully in advance.

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Materials Processing Technology

2173540, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Introduction

Polymers:

Raw materials, materials laws and models, rheology, moulding, forming, joining

Ceramics:

raw materials, powder synthesis, additives, moulding and forming of glass, moulding, abrasive techniques, changing properties, final processing

metals:

raw materials, materials processing, moulding, forming, cutting, joining

semiconductors:

raw materials, moulding, changing properties

Summary

objectives:

The students are able to name the different materials processing techniques and can the describe their basic principles and allocate them to the different classes of metarials processing methods.

They can chose specific processing techniques based on given problems and consider constraints derived from their basic knowledge in materials science.

The students are able to carry out simple experiments with lab scale equipment. They can correlate the processing parameters with resulting material properties by analyzing the materials using adequate testing methods which have to be chosen, evaluated and documented suitable to the problems given.

requirements:

none, **Recommendations:** Module "Basics in Materials Science" should be passed

workload:

The workload for the study program MatWerk for the lecture “materials processing technology” is 180 h per semester and consists of the presence during the lectures (36 h) including tutorials, presence during the lab course (12 h), preparation and rework time at home (72 h) and preparation time for the oral exam (60 h).

The workload for the study program Mechanical Engineering for the lecture “materials processing technology” is 120 h per semester and consists of the presence during the lectures (36 h) including tutorials, preparation and rework time at home (24 h) and preparation time for the oral exam (60 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given

V Materials Processing Lab Course

Practical course (P)
On-Site

2173541, WS 25/26, 1 SWS, Language: German, Open in study portal

Content
Content and objectives:

The students are able to carry out simple experiments with lab scale equipment. They can correlate the processing parameters with resulting material properties by analyzing the materials using adequate testing methods which have to be chosen, evaluated and documented suitable to the problems given.

Organizational issues
In den Laborräumen von IAM, wbk und Fhg-ICT. Gruppeneinteilung und Termine werden in VL "Werkstoffprozesstechnik" bekannt gegeben.

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given

T 3.219 Module component: Materials Science and Engineering III [T-MACH-105301]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each winter term	2

Courses					
WT 25/26	2173553	Materials Science and Engineering III	4 SWS	Lecture / 🗣	Heilmaier, Guth
WT 25/26	2173554	Exercises in Materials Science and Engineering III	1 SWS	Practice / 🗣	Heilmaier, Schliephake
Exams					
ST 2025	76-T-MACH-105301	Materials Science III			Heilmaier, Guth
WT 25/26	76-T-MACH-105301	Materials Science III			Heilmaier, Guth

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 35 minutes

Prerequisites
T-MACH-110818 - Plasticity of Metals and Intermetallics has not been started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110818 - Plasticity of Metals and Intermetallics must not have been started.

Additional Information
The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Materials Science and Engineering III

2173553, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatmens and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatmens.

requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

workload:

regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

T 3.220 Module component: Mathematical Methods in Dynamics [T-MACH-105293]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
ST 2025	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture /	Proppe
WT 25/26	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture /	Proppe
WT 25/26	2161207	Mathematical Methods in Dynamics (Tutorial)	1 SWS	Practice /	Proppe, Luo
Exams					
ST 2025	76-T-MACH-105293	Mathematical Methods in Dynamics			Proppe

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

Assessment
written examination, 180 min.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Mathematical Methods in Dynamics

2161206, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

Content
The students know precisely the mathematical methods of dynamics. They are able to use the basic mathematical methods for modelling the dynamical behaviour of elastic and rigid bodies. The students also have a basic understanding of the description of kinematics and kinetics of bodies. They also master the alternative fomulations based on weak formulations and variational methods and the approximate solution methods for numerical calculations of the moving behaviour of elastic bodies.

Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Organizational issues
Für diese Vorlesung werden online Unterlagen bereitgestellt.

Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

V Mathematical Methods in Dynamics

2161206, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Content
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

V Mathematical Methods in Dynamics (Tutorial)

2161207, WS 25/26, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Excercises related to the lecture

T 3.221 Module component: Mathematical Methods in Fluid Mechanics [T-MACH-113955]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Davide Gatti

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	3

Courses					
WT 25/26	2154540	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/ 🗣	Gatti, Frohnapfel
Exams					
ST 2025	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written examination - 90 minutes

Prerequisites
T-MACH-105295 and T-MACH-113956 must not have been started.

Recommendations
Basic Knowledge about Fluid Mechanics

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Mathematical Methods in Fluid Mechanics

2154540, WS 25/26, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

T 3.222 Module component: Mathematical Methods in Fluid Mechanics [T-MACH-113956]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Davide Gatti

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	4

Courses					
ST 2025	2154540	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/ 🗣	Gatti, Frohnapfel
WT 25/26	2154540	Mathematical Methods in Fluid Mechanics	4 SWS	Lecture / Practice (/ 🗣	Gatti, Frohnapfel
Exams					
ST 2025	76-T-MACH-105295 (engl.)	Mathematical Methods in Fluid Mechanics			Gatti, Frohnapfel
WT 25/26	76-T-MACH-113956	Mathematical Methods in Fluid Mechanics			Frohnapfel, Gatti

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

Assessment
written examination - 90 minutes

Prerequisites
T-MACH-105295 and T-MACH-113955 must not have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-113955 - Mathematical Methods in Fluid Mechanics must not have been started.

Recommendations
Basic Knowledge about Fluid Mechanics

Additional Information
The course is offered in English.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Mathematical Methods in Fluid Mechanics

2154540, SS 2025, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

V

Mathematical Methods in Fluid Mechanics

2154540, WS 25/26, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

T 3.223 Module component: Mathematical Methods in Micromechanics [T-MACH-110378]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	5 CP	graded	Each summer term	1 semesters	2

Courses					
ST 2025	2162280	Mathematical Methods in Micromechanics	2 SWS	Lecture / 🗣	Böhlke, Langhoff
Exams					
ST 2025	76-T-MACH-110378	Mathematical Methods in Micromechanics			Böhlke

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

Assessment
written exam (90 min). Additives as announced.

prerequisite to registration to the exam: Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

Prerequisites
Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110379 - Tutorial Mathematical Methods in Micromechanics must have been passed.

Additional Information
The corresponding course is offered in German.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Mathematical Methods in Micromechanics

2162280, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Fundamentals of linear isotropic and anisotropic thermoelasticity theory,
Description of microstructures,
Micro-macro relations of linear thermoelasticity theory,
Approximations and bounds for the effective thermoelastic material behavior,
Microstructure Sensitive Design of materials,
Selected problems in the context of homogenization of nonlinear material properties

Literature

- Vorlesungsskript
- Gummert, P.; Reckling, K.-A.: Mechanik. Vieweg 1994
- Gross, D., Seelig, T.: Bruchmechanik – Mit einer Einführung in die Mikromechanik, Springer 2002
- Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977
- Torquato, S.: Random Heterogeneous Materials. Springer, 2002

T 3.224 Module component: Mathematical Methods of Vibration Theory [T-MACH-105294]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2162241	Mathematical methods of vibration theory	2 SWS	Lecture / 🗣	Fidlin, Genda
ST 2025	2162242	Mathematical methods of vibration theory (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Genda, Mukherjee
Exams					
ST 2025	76-T-MACH-105294	Mathematical Methods of Vibration Theory			Fidlin

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written examination, 180 min.

Prerequisites
none

Recommendations
Engineering Mechanics III/IV

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Mathematical methods of vibration theory

2162241, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Linear, time-invariant, ordinary single differential equations: homogeneous solution; harmonic, periodic and non-periodic excitations; Duhamel's integral; Fourier and Laplace transform; introduction into the theory of distributions; Systems of ordinary differential equations: matrix notation, eigenvalue theory, fundamental matrix, forced vibrations via modal expansion and transition matrix; Introduction into the dynamic stability theory; Partial differential equations: solution in product form, eigenvalue theory, modal expansion using Ritz series; Variational methods, Hamilton's principle, boundary value problems representing vibrating continua; Perturbation methods

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

V Mathematical methods of vibration theory (Tutorial)

2162242, SS 2025, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Seven tutorials with examples of the contents of the course

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

T 3.225 Module component: Mathematical Models and Methods for Production Systems [T-MACH-105189]

Coordinators: Dr.-Ing. Marion Baumann
Prof. Dr.-Ing. Kai Furmans

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

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

Prerequisites
none

Additional Information
The next course will take place in the summer semester of 2026.

The course is offered in English

Workload
180 hours

T 3.226 Module component: Mathematical Models and Methods of the Theory of Thermochemical Processes [T-MACH-113942]

Coordinators: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2165521	Mathematical Models and Methods of the Theory of Thermochemical Processes	2 SWS	Lecture / 🗣	Bykov
Exams					
WT 25/26	76T-MACH-113942	Mathematical Models and Methods of the Theory of Thermochemical Processes			Bykov

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 30 min

Prerequisites
T-MACH-114062 and T-MACH-105419 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114062 - Mathematical Models and Methods of the Theory of Thermochemical Processes must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.227 Module component: Mathematical Models and Methods of the Theory of Thermochemical Processes [T-MACH-114062]

Coordinators: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2165522	Mathematical Models and Methods of the Theory of Thermochemical Processes	2 SWS	Lecture / 🗣	Bykov
Exams					
WT 25/26	76T-MACH-114062	Mathematical Models and Methods of the Theory of Thermochemical Processes			Bykov

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 30 min

Prerequisites
T-MACH-113942 and T-MACH-105419 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-113942 - Mathematical Models and Methods of the Theory of Thermochemical Processes must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

T 3.228 Module component: Measurement and Control Systems [T-MACH-103622]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	3137020	Measurement and Control Systems	3 SWS	Lecture / 🗣	Stiller
WT 25/26	3137021	Measurement and Control Systems (Tutorial)	1 SWS	Practice / 🗣	Stiller
Exams					
ST 2025	76-T-MACH-103622	Measurement and Control Systems			Stiller
WT 25/26	76-T-MACH-103622	Measurement and Control Systems			Stiller

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

Assessment
oral exam (30 min)

Prerequisites
none

Additional Information
The course is offered in English

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Measurement and Control Systems

3137020, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Lehrinhalt (EN):

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

Lernhziele (EN):

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

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

Arbeitsaufwand (EN): 180 hours

Literature

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York,1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- 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
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

V **Measurement and Control Systems (Tutorial)** **Practice (Ü) On-Site**
3137021, WS 25/26, 1 SWS, Language: English, Open in study portal

Content
Tutorial for Measurement and Control Systems

T 3.229 Module component: Measurement Instrumentation Lab [T-MACH-105300]

Coordinators: Jonas Merkert
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2138328	Measurement Instrumentation Lab	2 SWS	Practical course / 🗣	Stiller, Merkert
Exams					
ST 2025	76-T-MACH-105300	Measurement Instrumentation Lab			Stiller

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Non graded colloquia

Prerequisites
none

Additional Information
The course is offered in English

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Measurement Instrumentation Lab

2138328, SS 2025, 2 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

Content
Please consider the bulletin on our website!

A Signal recording

- measurement of temperature
- measurement of lengths

B Signal pre-precessing

- bridge circuits and principles of measurement
- analog/digital transducers

C Signal processing

- measuring stochastic signals

D Complete systems

- system identification
- inverse pendulum
- mobile robot platform

Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand: 90 hours

Lernziele (EN):

The laboratory complements the course "Introduction to Measurement and Control". While the course is organized into principles and subsystems, the laboratory presents complete measurement systems and methods for the most relevant industrial measurands.

Literature
Anleitungen auf der Homepage des Instituts erhältlich.

Instructions to the eyperiments are available on the institute's website

T 3.230 Module component: Mechanics and Strength of Polymers [T-MACH-105333]

Coordinators: Hon.-Prof. Dr. Bernd-Steffen von Bernstorff
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2173580	Mechanics and Strengths of Polymers	2 SWS	Lecture / 🗣	von Bernstorff

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
none

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

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Mechanics and Strengths of Polymers

2173580, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Molecular structure and morphology of polymers, temperature- and time dependency of mechanical behavior, viscoelasticity, time/temperature- superposition principle, yielding, crazing and fracture of polymers, failure criterions, impact and dynamic loading, corresponding principle, tough/brittle-transition, introduction to the principles of fiber reinforcement and multiple cracking in composites

learning objectives:

The students are prepared to

- repeat the calculus on strength and design of engineering parts exposed to complex loadings,
- estimate the influence of time and temperature on the strength of polymeric materials,
- relate the strength of materials to their molecular structure, morphology and processing parameters and
- derive failure mechanisms for homogenuous polymers and composite materials therefrom.

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

workload:

The workload for the lecture Mechanics and Strengths of Polymers is 120 h per semester and consists of the presence during the lecture (28 h) as well as preparation and rework time at home (92 h).

Organizational issues
berndvonbernstorff@t-online.de

Literature
Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben

T 3.231 Module component: Mechanics in Microtechnology [T-MACH-105334]

Coordinators: Prof. Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2177013	Mechanical Properties of Nanomaterials and Microsystems	2 SWS	Lecture / 🗣	Kirchlechner, Gruber, Greiner, Weygand
Exams					
ST 2025	76-T-MACH-105334	Mechanics in Microtechnology			Gruber, Greiner

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

Assessment
Oral examination, ca. 30 min

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Mechanical Properties of Nanomaterials and Microsystems

2177013, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction: Application and Processing of Microsystems
2. Scaling Effects
3. Fundamentals: Stress and Strain, (anisotropic) Hooke's Law
4. Fundamentals: Mechanics of Beams and Membranes
5. Thin Film Mechanics: Origin and Role of Mechanical Stresses
6. Characterization of Mechanical Properties of Thin Films and Small Structures: Measurement of Stresses and Mechnical Parameters such as Young'sModulus and YieldDtrength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Elektrostatics,...
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Elektromagnetic Actuation,…

The students know and understand size and scaling effects in micro- and nanosystems. They understand the impact of mechanical phenomena in small dimensions. Based on this they can judge how they determine material processing as well as working principles and design of microsensors and microactuators.

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Folien,
1. M. Ohring: "The Materials Science of Thin Films", Academic Press, 1992
2. L.B. Freund and S. Suresh: "Thin Film Materials"
3. M. Madou: Fundamentals of Microfabrication", CRC Press 1997
4. M. Elwenspoek and R. Wiegerink: "Mechanical Microsensors" Springer Verlag 2000
5. Chang Liu: Foundations of MEMS, Illinois ECE Series, 2006

T 3.232 Module component: Mechanics of Laminated Composites [T-MACH-108717]

Coordinators: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2161983	Mechanics of laminated composites	2 SWS	Lecture / 🗣	Schnack

Legend: 💻 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 20 minutes

Prerequisites
none

Additional Information
The lecture notes are made available via ILIAS.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Mechanics of laminated composites

2161983, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Definition of composites, definition of static and kinematic groups. Definition of material laws. Transformation of the state values of composites and transformation of the material properties for the coordinate systems in the design of machine structures.

T 3.233 Module component: Mechano-Informatics and Robotics [T-INFO-101294]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2400077	Mechano-Informatics and Robotics	2 SWS	Lecture / 🗣	Asfour, Krebs, Rietsch, Gao
Exams					
ST 2025	7500217	Mechano-Informatics and Robotics			Asfour
WT 25/26	7500176	Mechano-Informatics and Robotics			Asfour

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
None.

Recommendations
Basispraktikum Mobile Roboter

Below you will find excerpts from courses related to this module component:

V Mechano-Informatics and Robotics

2400077, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture addresses various engineering and algorithmic aspects and topics in robotics which are illustrated and explained based on examples originating from current research conducted in the field of humanoid robotics. First, this lecture gives an introduction into the mathematical fundamentals which are needed to describe a robotic system as well as the basic algorithms commonly applied in motion planning.
Subsequently, models and methods are introduced with which dynamical systems can be formalized and which can be used to encode and represent robot actions. To do so, we will discuss linear time-invariant systems in state.

Learning Objectives:

Based on the example of robotics students understand the synergistic effects and interdisciplinarity of mechatronics and informatics, the embedded systems, the control, and the methods and the algorithms. They are acquainted with the basic terminology and the methods which are common in robotics, signal processing, action representation, machine learning and cognitive systems. They are capable of applying fundamental state-of-the-art methods and tools for the development and programming of robots. Based on
examples originating from current research conducted in the fields of humanoid robotics, the students interactively learn how to identify and formalize problems and tasks and how to develop solutions in an analytical and goal-directed way.

Organizational issues
Associated courses: Recommendation - Basispraktikum Mobile Roboter

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) usually lasting 60 minutes.

Workload:
2h attendance

+ 2*2h = 4h preparation/follow-up work

+ 30h exam preparation

120h

T 3.234 Module component: Mechatronical Systems and Products [T-MACH-105574]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	4

Courses					
ST 2025	2303003	Exercises for 2303161 Mechatronical Systems and Products	1 SWS	Practice / 🗣	Matthiesen, Hohmann
ST 2025	2303161	Mechatronical Systems and Products	2 SWS	Lecture / 🏵	Matthiesen, Hohmann
Exams					
ST 2025	76-T-MACH-105574	Mechatronical Systems and Products			Matthiesen
WT 25/26	76-T-MACH-105574	Mechatronical Systems and Products			Matthiesen

Legend: 🖥 Online, 🏵 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written examination (duration: 60min)

Additional Information
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " Anmeldung und Gruppeneinteilung " in ILIAS before the start of the semester.

The course is offered in German.

Workload
90 hours

T 3.235 Module component: Medical Imaging Technology [T-ETIT-113625]

Coordinators: Prof. Dr.-Ing. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2305263	Medical Imaging Technology	4 SWS	Lecture / Practice (/ 🗣	Spadea, Arndt
Exams					
ST 2025	7305260	Medical Imaging Technology			Spadea, Arndt
WT 25/26	7305260	Medical Imaging Technology			Spadea

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The examination takes place in form of a written examination lasting 120 minutes. The course grade is the grade of the written exam.

Prerequisites
none

T 3.236 Module component: Medical Measurement Technology [T-ETIT-113607]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2305269	Medical Measurement Techniques	4 SWS	Lecture / 🗣	Nahm
Exams					
ST 2025	7305270	Medical Measurement Technology			Nahm

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

Assessment
The assessment takes place in the form of a written examination lasting 120 min. and 120 points.

The module grade is the grade of the written exam.

Bonus points can also be awarded for a student presentation within the lecture. Bonus points are awarded as follows:

- solving bonus tasks is voluntary.
- students register in ILIAS in groups of max. 3 participants for a bonus task.
- the solution to the bonus task must be entered in ILIAS by the specified submission deadline.
- the solutions are read by the lecture assistants and, if necessary, corrected and approved.
- the groups present their solutions in the lecture (20 min).
- the bonus points are awarded individually to each student by the lecturer on the basis of the written solution and the presentation.
- Each student can earn a maximum of 6 bonus points.
- Bonus points can only be earned once.

The bonus points are credited as follows:

- A maximum of 6 points can be credited to the exam result for the passed bonus task.
- The grade can thus be improved by a maximum of one grade step.
- The total number of points remains limited to 120 points. The bonus points are only taken into account if the exam is passed. Bonus points do not expire and are retained for any examinations taken at a later date.

Prerequisites
none

T 3.237 Module component: Metal Forming [T-MACH-105177]

Coordinators: Prof. Dr.-Ing. Thomas Herlan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2150681	Metal Forming	2 SWS	Lecture / 🗣	Herlan
Exams					
ST 2025	76-T-MACH-105177	Metal Forming			Herlan

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral Exam (20 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Metal Forming** — **Lecture (V) On-Site**
2150681, SS 2025, 2 SWS, Language: German, Open in study portal

Content
At the beginning of the lecture the basics of metal forming are briefly introduced. The focus of the lecture is on massive forming (forging, extrusion, rolling) and sheet forming (car body forming, deep drawing, stretch drawing). This includes the systematic treatment of the appropriate metal forming Machines and the corresponding tool technology. Aspects of tribology, as well as basics in material science and aspects of production planning are also discussed briefly. The plastic theory is presented to the extent necessary in order to present the numerical simulation method and the FEM computation of forming processes or tool design. The lecture will be completed by product samples from the forming technology.

The topics are as follows:

- Introduction and basics
- Hot forming
- Metal forming machines
- Tools
- Metallographic fundamentals
- Plastic theory
- Tribology
- Sheet forming
- Extrusion
- Numerical simulation
- Sustainability in forming technology
- I4.0 and AI applications
- Production planning and quality assurance

Learning Outcomes:

The students …

- are able to reflect the basics, forming processes, tools, Machines and equipment of metal forming in an integrated and systematic way.
- are capable to illustrate the differences between the forming processes, tools, machines and equipment with concrete examples and are qualified to analyze and assess them in terms of their suitability for the particular application.
- are also able to transfer and apply the acquired knowledge to other metal forming problems.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Vorlesungstermine freitags, wöchentlich.
Die konkreten Termine werden in der ersten Vorlesung bekannt gegeben und auf der Institutshomepage und ILIAS veröffentlicht.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.238 Module component: Metallographic Lab Class [T-MACH-105447]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Alexander Kauffmann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	3

Assessment
Colloquium for every experiment, about 60 minutes, protocol

Prerequisites
T-MACH-114076 - Metallographic Lab Class must not have started.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.239 Module component: Metals [T-MACH-105468]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2174598	Metals	4 SWS	Lecture / 🗣	Pundt, Wagner
ST 2025	2174599	Exercises in Metals	1 SWS	Practice / 🗣	Wagner

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 20 minutes

Prerequisites
none

Additional Information
he course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Metals

2174598, SS 2025, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 42 h

Self-study: 138 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

G. Gottstein. Physikalische Grundlagen der Materialkunde, Springer 2007

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001

H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005

J. Rösler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008

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

V Exercises in Metals

2174599, SS 2025, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

Learning objectives:
The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

Requirements:
Lecture and Tutorials on Materials Physics as well as the lecture on Metals

Workload:

Regular attendance: 14 h

Self-study: 16 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

T 3.240 Module component: Methods of Signal Processing [T-ETIT-100694]

Coordinators: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2302113	Signal Processing Methods	2 SWS	Lecture / 🗣	Wahls
WT 25/26	2302115	Tutorial to 2302113 Signal Processing Methods	2 SWS	Practice / 🗣	Wahls, Al-Hammadi
Exams					
ST 2025	7302113	Signal Processing Methods			Wahls

Legend: 💻 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Prerequisites
none

T 3.241 Module component: Micro Magnetic Resonannce [T-MACH-105782]

Coordinators: Prof. Dr. Jan Gerrit Korvink
Dr. Neil MacKinnon

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2141501	Micro Magnetic Resonance	2 SWS	Seminar /	MacKinnon, Badilita, Jouda, Korvink

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

Assessment
Own Presentation, participation at the course discussions, result is passed or failed.

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Micro Magnetic Resonance

2141501, WS 25/26, 2 SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

T 3.242 Module component: Microactuators [T-MACH-101910]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2142881	Microactuators	2 SWS	Lecture / 🗣	Kohl
Exams					
ST 2025	7600030	Microactuators			Kohl
ST 2025	76-T-MACH-101910	Microactuators			Kohl

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

Assessment
written exam, 60 min.

Prerequisites
T-MACH-114036 must not be started

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Microactuators

2142881, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
- Basic knowledge in the material science of the actuation principles
- Layout and design optimization
- Fabrication technologies
- Selected developments
- Applications

The lecture includes amongst others the following topics:

- Microelectromechnical systems: linear actuators, microrelais, micromotors
- Medical technology and life sciences: Microvalves, micropumps, microfluidic systems
- Microrobotics: Microgrippers, polymer actuators (smart muscle)
- Information technology: Optical switches, mirror systems, read/write heads

Literature
- Folienskript "Mikroaktorik"
- D. Jendritza, Technischer Einsatz Neuer Aktoren: Grundlagen, Werkstoffe, Designregeln und Anwendungsbeispiele, Expert-Verlag, 3. Auflage, 2008
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004
- N.TR. Nguyen, S.T. Wereley, Fundamentals and applications of Microfluidics, Artech House, Inc. 2002
- H. Zappe, Fundamentals of Micro-Optics, Cambride University Press 2010

T 3.243 Module component: Microenergy Technologies [T-MACH-105557]

Coordinators: Prof. Dr. Manfred Kohl
Dr. Jingyuan Xu

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2142897	Microenergy Technologies	2 SWS	Lecture / 🗣	Xu
Exams					
ST 2025	76-T-MACH-105557	Microenergy Technologies			Kohl

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination (30 Min.)

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Microenergy Technologies

2142897, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
- Basic physical principles of energy conversion
- Layout and design optimization
- Technologies
- Selected devices
- Applications

The lecture includes amongst others the following topics:

- Micro energy harvesting of vibrations using different conversion principles (piezo, electrostatic, electromagnetic, etc.)
- Thermoelectric energy generation
- Novel thermal energy conversion principles (thermomagnetic, pyroelectric)
- Miniature scale solar devices
- RF energy harvesting
- Miniature scale heat pumping
- Solid-state cooling technologies (magneto-, electro-, mechanocalorics)
- Power management
- Energy storage technologies (microbatteries, supercapacito4rs, fuel cells)

Literature
- Folienskript "Micro Energy Technologies"
- Stephen Beeby, Neil White, Energy Harvesting for Autonomous Systems, Artech House, 2010
- Shashank Priya, Daniel J. Inman, Energy Harvesting Technologies, Springer, 2009

T 3.244 Module component: Microstructure-Property-Relationships [T-MACH-114399]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each winter term	1

Courses					
WT 25/26	2177020	Microstructure-Property-Relationships	3 SWS	Lecture /	Kirchlechner, Bansal, Vrellou, Gruber

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

Assessment
Oral exam (about 30 min)

Prerequisites
The successful participation in T-MACH-114408 – Exercises for Microstructure-Properties-Relationships is the condition for the admittance to the oral exam in Microstructure-Properties-Relationships.

T-MACH-114407 – Übungen zu Gefüge-Eigenschafts-Beziehungen has not been started.

T-MACH-114398 - Gefüge-Eigenschafts-Beziehungen has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114408 - Exercises for Microstructure-Property-Relationships must have been passed.

Additional Information
The course is offered in English.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Microstructure-Property-Relationships

2177020, WS 25/26, 3 SWS, Language: English, Open in study portal

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

Content
The following microstructure-property-relationships will be discussed for all material classes:

- Elasticity and plasticity
- Fracture mechanics
- Fatigue
- Creep
- Electrical conductivity: Metallic conductors, semiconductors, superconductors, conductive polymers
- Magnetic properties und materials

In addition to the phenomenological description and physical explanation of the material properties an overview on the corresponding experimental techniques will be given.

The students fundamentally understand the interrelation between the microstructure and the properties of a material. This interrelation will be elaborated for mechanical properties (elasticity, plasticity, fracture, fatigue, creep) as well as functional properties (conductivity, magnetic properties) for all material classes, respectively. The students are able to phenomenological describe the material properties, to explain the underlying physical mechanisms and to understand how the properties can be specifically modified by the microstructure of the material. In the other way they are able to deduce the mechanical and functional properties of a material on the basis of its microstructure.

oral exam ca. 30 minutes

T 3.245 Module component: Microsystem Simulation [T-MACH-108383]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Assessment
written exam

Prerequisites
T-MACH-114072 must not be started.

Workload
120 hours

T 3.246 Module component: Mobile Machines [T-MACH-105168]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each summer term	2

Courses					
ST 2025	2114073	Mobile Machines	4 SWS	Lecture / 🗣	Geimer, Kazenwadel
Exams					
ST 2025	76-T-MACH-105168	Mobile Machines			Geimer
WT 25/26	76T-MACH-105168	Mobile Machines			Geimer

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of an oral exam (45 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Recommendations
Knowledge in Fluid Power Systems is required. It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

Additional Information
Learning objectives:

After successful participation in the course:

- the student will be able to name the wide range of mobile machinery
- know the possible applications and operating sequences of the most important mobile machines
- be able to describe selected subsystems and components

Content:

- Presentation of the components used and the most important mobile machines
- Basics and structure of the machines
- Practical insights into the development of the machines

Media:

Downloadable set of slides for the lecture

Book "Grundlagen mobiler Arbeitsmaschinen", Karlsruhe series of publications on vehicle systems technology, Volume 22, KIT Scientific Publishing

The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V **Mobile Machines** — **Lecture (V) On-Site**
2114073, SS 2025, 4 SWS, Language: German, Open in study portal

Content

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

Knowledge in Fluid Power is required.

Recommendations:

It is recommended to attend the course *Fluid Power* [2113092] or *Mathematische Methoden der Hydraulik* [2113090] beforehand.

- regular attendance: 42 hours
- self-study: 184 hours

T 3.247 Module component: Model Reduction Methods for Modeling and Simulation of Reacting Flows [T-MACH-114060]

Coordinators: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2166540	Reduction methods for the modeling and the simulation of combustion processes	2 SWS	Lecture / 🗣	Bykov
Exams					
ST 2025	76T-MACH-114060	Model Reduction Methods for Modeling and Simulation of Reacting Flows			Bykov
WT 25/26	76T-MACH-114060	Model Reduction Methods for Modeling and Simulation of Reacting Flows			Bykov

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 20 min

Prerequisites
T-MACH-114061 and T-MACH-105421 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114061 - Model Reduction Methods for Modeling and Simulation of Reacting Flows must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

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

Lecture (V)
On-Site

2166540, SS 2025, 2 SWS, Language: German/English, Open in study portal

Content
The course concerns the problem of model reduction to save CPU time for integrations and simulations of chemical kinetic models of reacting flows. The principles of model reduction will be outlined. The basic mathematical concepts and methods of analysis of chemical reaction mechanisms will be introduced. The framework and detailed implementation scheme of model reduction will be introduced. The course will cover simplified and idealized models and examples in system biology of bio-chemical as well as combustion processes. These will be introduced, analyzed and reduced. The theoretical and numerical tools will be combined, implemented and illustrated by using these simple examples.

Organizational issues
Termin: Mi, 14:00-15:30. Für Änderungen siehe Aushang im ITT-Schaukasten und auf der Internetseite des Instituts.

Literature
N. Peters, B. Rogg: Reduced kinetic mechanisms for aplication in combustion systems, Lecture notes in physics, 15, Springer Verlag, 1993.

T 3.248 Module component: Model Reduction Methods for Modeling and Simulation of Reacting Flows [T-MACH-114061]

Coordinators: Dr. Viatcheslav Bykov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2166540	Reduction methods for the modeling and the simulation of combustion processes	2 SWS	Lecture / 🗣	Bykov
Exams					
ST 2025	76T-MACH-114061	Model Reduction Methods for Modeling and Simulation of Reacting Flows			Bykov

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 20 min

Prerequisites
T-MACH-114060 and T-MACH-105421 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114060 - Model Reduction Methods for Modeling and Simulation of Reacting Flows must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

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

Lecture (V)
On-Site

2166540, SS 2025, 2 SWS, Language: German/English, Open in study portal

Content
The course concerns the problem of model reduction to save CPU time for integrations and simulations of chemical kinetic models of reacting flows. The principles of model reduction will be outlined. The basic mathematical concepts and methods of analysis of chemical reaction mechanisms will be introduced. The framework and detailed implementation scheme of model reduction will be introduced. The course will cover simplified and idealized models and examples in system biology of bio-chemical as well as combustion processes. These will be introduced, analyzed and reduced. The theoretical and numerical tools will be combined, implemented and illustrated by using these simple examples.

Organizational issues
Termin: Mi, 14:00-15:30. Für Änderungen siehe Aushang im ITT-Schaukasten und auf der Internetseite des Instituts.

Literature
N. Peters, B. Rogg: Reduced kinetic mechanisms for aplication in combustion systems, Lecture notes in physics, 15, Springer Verlag, 1993.

T 3.249 Module component: Modeling and Simulation [T-MACH-105297]

Coordinators: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Luise Kärger

Organisation: KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each winter term	2

Exams			
ST 2025	76-T-MACH-105297	Modeling and Simulation	Geimer, Furmans, Kärger
WT 25/26	76-T-MACH-105297	Modeling and Simulation	Furmans, Geimer, Kärger

Assessment
The assessment consists of a 180 minutes written examination.

Prerequisites
none

Additional Information
Last held in winter semester 24/25. From winter semester 25/26, this course will no longer be offered. It will be replaced by two new courses, one of which (Numerical Methods for Engineering Applications, 4 CP, starting summer semester 25) will always be offered in the summer semester and a second course (3 CP) will always be offered in the winter semester.

Workload
210 hours

T 3.250 Module component: Modeling of Thermodynamical Processes [T-MACH-105396]

Coordinators: Prof. Dr. Ulrich Maas
Dr.-Ing. Robert Schießl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each term	1

Exams			
ST 2025	76-T-MACH-105396	Modeling of Thermodynamical Processes	Maas
WT 25/26	76-T-MACH-105396	Modeling of Thermodynamical Processes	Maas

Assessment
Oral exam, approx. 30 min

Prerequisites
none

Workload
180 hours

T 3.251 Module component: Modeling of Turbulent Flows - RANS and LES [T-BGU-110842]

Coordinators: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	6 CP	graded	Each term	1 semesters	1

Courses					
WT 25/26	6221911	Modelling of Turbulent Flows - RANS and LES	4 SWS	Lecture / Practice (/ 🗣	Uhlmann

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

Assessment
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
180 hours

T 3.252 Module component: Modeling Physiological Systems [T-ETIT-113630]

Coordinators: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Assessment
The examination takes place in form of a written examination lasting 90 min.

The module grade is the grade of the written exam.

Prerequisites
"T-ETIT-114690 – Modeling Physiological Systems - Workshop" must be passed in order to register for this written examination.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-114690 - Modeling Physiological Systems - Workshop must have been passed.

T 3.253 Module component: Modeling Physiological Systems - Workshop [T-ETIT-114690]

Coordinators: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Assessment
Success control takes place in the form of ungraded course works. Three workshop tasks must be submitted.

Prerequisites
none

Additional Information
This success control must be passed in order to register for the written examination.

T 3.254 Module component: Modelling and Simulation [T-MACH-114488]

Coordinators: Prof. Dr. Britta Nestler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	1

Courses					
WT 25/26	2183709	Modelling and Simulation	3 SWS	Lecture / Practice (/	Nestler, August, Prahs, Koeppe

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

Assessment
written exam, 90 min (graded)

Prerequisites
T-MACH-114489 – Modellierung und Simulation - Computerpraktikum has to be successfully passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114489 - Modelling and Simulation - Computer Lab must have been passed.

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Modelling and Simulation

2183709, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

T 3.255 Module component: Modelling and Simulation - Computer Lab [T-MACH-114489]

Coordinators: Prof. Dr. Britta Nestler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each term	1

Courses					
WT 25/26	2183709	Modelling and Simulation	3 SWS	Lecture / Practice (/	Nestler, August, Prahs, Koeppe

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

Assessment
Students present their solutions in 5 sessions on the PC

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Modelling and Simulation

2183709, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

T 3.256 Module component: Modelling of Microstructures [T-MACH-105303]

Coordinators: Dr. Anastasia August
Prof. Dr. Britta Nestler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	4

Courses					
WT 25/26	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (/ 🗣	August, Prahs, Nestler, Koeppe
Exams					
ST 2025	76-T-MACH-105303	Modelling of Microstructures			August, Nestler, Weygand
WT 25/26	76-T-MACH-105303	Modelling of Microstructures			August, Weygand, Nestler

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam 30 min

Prerequisites
none

Recommendations
materials science
fundamental mathematics

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Modelling of Microstructures

2183702, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

- Brief Introduction in thermodynamics
- Gibbs free energy and phase diagrams
- Free energy functional
- Phasefield equation
- Driving forces
- Grand chemical potential functional and the evolution equations
- Numeric solution of the phasefield equation

The student can

- explain the thermodynamic and statistical foundations for liquid-solid and solid-solid phase transition processes and apply them to construct phase diagrams.
- explain the mechanisms of phase boundary motion induced under driving forces
- use the phase-field method for simulation of microstructure formation processes
- have experiences in computing and conduction simulations of microstructure formation from an integrated computer lab.

Knowledge in materials science and in fundamental mathematics recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

oral exam ca. 30 min

Organizational issues
Terminvereinbarung für die mündliche Prüfung: Sobald Sie wissen, wann Sie die Prüfung ablegen möchten, schreiben Sie bitte eine Mail an die Prüferin Anastasia August (anastasia.august2@kit.de) und schlagen Sie einen oder mehrere Termin/e vor. Die Prüfung dauert ca. 30 Minuten.

Literature

1. Gottstein, G. (2007) Physikalische Grundlagen der Materialkunde. Springer Verlag Berlin Heidelberg
2. Kurz, W. and Fischer, D. (1998) Fundamentals of Solidification. Trans Tech Publications ltd, Switzerland Germany UK USA
3. Porter, D.A. Eastering, K.E. and Sherif, M.Y. (2009) Phase transformation in metals and alloys (third edition). CRC Press, Taylor & Francis Group, Boca Raton, London, New York
4. Gaskell, D.R., Introduction to the thermodynamics of materials

T 3.257 Module component: Modern Control Concepts I [T-MACH-105539]

Coordinators: apl. Prof. Dr. Lutz Groell
apl. Prof. Dr. Jörg Matthes

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2105024	Modern Control Concepts I	2 SWS	Lecture /	Matthes, Groell
ST 2025	2106020	Tutorial on Modern Control Concepts I	2 SWS	Practice /	Matthes
Exams					
ST 2025	76-T-MACH-105539	Modern Control Concepts I			Matthes

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

Assessment
Written exam (Duration: 1 h)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Modern Control Concepts I

2105024, SS 2025, 2 SWS, Language: German, Open in study portal

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

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

V Tutorial on Modern Control Concepts I

2106020, SS 2025, 2 SWS, Language: German, Open in study portal

Practice (Ü)
Online

Content
Learning Content:

1. Introduction (system classes, nomenclature)
2. Equilibria
3. Linearization (software based, Hartman-Grobman-Theorem)
4. Parameter identification of linear dynamic models (SISO+MIMO)
5. PID-controller (realization, design-hints, Anti-Windup-mechanisms)
6. Conzept of 2DOF-Controllers (structure, reference signal design)
7. State space (geometric view)
8. Controller with state feedback and integrator expansion (LQ-design, Eigenvalue placement, decoupling design)
9. Observer (LQG-design, disturbance observer, reduced observer)

Recommendations:

Attendance of the following lectures is reccomendet:

- Grundlagen der Mess- und Regelungstechnik

Alternatively: Comparable courses of the faculty of electrical engineering

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

T 3.258 Module component: Motor Vehicle Labor [T-MACH-105222]

Coordinators: Dr.-Ing. Michael Frey
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	5

Courses					
ST 2025	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
WT 25/26	2115808	Motor Vehicle Laboratory	2 SWS	Practical course / 🗣	Frey
Exams					
ST 2025	76-T-MACH-105222	Motor Vehicle Labor			Frey
WT 25/26	76-T-MACH-105222	Motor Vehicle Laboratory			Frey

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Colloquium before each experiment

After completion of the experiments: written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
T-MACH-114122 – Motor Vehicle Laboratory must not have been started

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Motor Vehicle Laboratory

2115808, SS 2025, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Behavior of car tires on wet road surface

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genauer Ort und Termine sowie weitere Infos siehe Institutshomepage.

Einteilung in
- Gruppe A: Mo 14:00 - 15:30
- Gruppe B: Mo 16:00 - 17:30
- Gruppe C: Di 09:00 - 10:30
- Gruppe D: Di 11:00 - 12:30
- Gruppe E: Di 14:00 - 15:30
- Gruppe F: Di 16:00 - 17:30

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

V

Motor Vehicle Laboratory

Practical course (P)
On-Site

2115808, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Investigation of acoustic behaviour of vehicles

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genaue Termine und weitere Hinweise: siehe Institutshomepage.

Einteilung:

Gruppe A: Mo 14:00-15:30

Gruppe B: Mo 16:00-17:30

Gruppe C: Di 09:00-10:30

Gruppe D: Di 11:00-12:30

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

T 3.259 Module component: Multi-Scale Plasticity [T-MACH-105516]

Coordinators: Prof. Dr. Christian Greiner
PD Dr.-Ing. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2181750	Multi-scale Plasticity	2 SWS	Lecture / 🗣	Greiner, Schulz

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

Assessment
oral exam, about 30 min

Prerequisites
none

Recommendations
preliminary knowlegde in mathematics, physics, mechanics and materials science

Additional Information

- limited number of participants
- mandatory registration
- mandatory attendance
- The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Multi-scale Plasticity

2181750, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This module will attempt to provide an overview to complex subjects in the field of material mechanics. For this purpose important scientific papers will be presented and discussed.
This will be done by having students read and critique one paper each week in a short review. In addition, each week will include presentation from one of the participants which aim to advocate or criticise each piece of work using the short reviews. He will also be the discussion leader, while students discuss the content, ideas, evaluation and open research questions of the paper. Using a professional conference management system (HotCRP), the student assume the role of reviewers and gain insight into the work of researchers.

The student

- can explain the physical foundations of plasticity as well as results of latest research.
- can independently read and evaluate scientific research papers.
- can present specific, technical information in structured, precise, and readable manner.
- is able to argue for and/or against a particular approach or idea using the knowledge acquired within the lecture.

preliminary knowlegde in mathematics, physics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

Exam: presentation (40%), oral examination (30 min, 60%)

The maximum number of students is 14 per semester.

Organizational issues
Blockveranstaltung in 5 Blöcken, Termine und Ort werden bekannt gegeben.

Anmeldung per Email an katrin.schulz@kit.edu bis zum 20.10.2025

T 3.260 Module component: NMR Micro Probe Hardware Conception and Construction [T-MACH-108407]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	1

Exams			
ST 2025	76-T-MACH-108407	NMR Micro Probe Hardware Conception and Construction	Korvink

Assessment
Successful participation.

Prerequisites
none

Workload
120 hours

T 3.261 Module component: Nonlinear Continuum Mechanics [T-MACH-111026]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2162344	Nonlinear Continuum Mechanics	4 SWS	Lecture / 🗣	Böhlke
Exams					
ST 2025	76-T-MACH-111026	Nonlinear Continuum Mechanics			Böhlke

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

Assessment
oral examination (approx. 25 min)

Prerequisites
Passing the "Tutorial Nonlinear Continuum Mechanics" (T-MACH-111027) is a prerequisite for taking part in the exam.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-111027 - Tutorial Nonlinear Continuum Mechanics must have been passed.

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description 2162344 "Nonlinear Continuum Mechanics"

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Nonlinear Continuum Mechanics

2162344, SS 2025, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- tensor calculus, kinematics, balance equations
- principles of material theory
- finite elasticity
- infinitesimal elasto(visco)plasticity
- exact solutions of infinitesimal plasticity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure
- strain localization

Organizational issues
Die Lehrveranstaltung wird als Blockveranstaltung geplant. Für weitere Informationen wenden Sie sich bitte an das Sekretariat.

Mit Zustimmung aller Teilnehmenden kann die Lehrveranstaltung auch auf Deutsch gehalten werden.

Literature

- Vorlesungsskript / Lecture Notes
- Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
- Liu, I-S.: Continuum Mechanics. Springer 2002.
- Schade, H.: Tensoranalysis.Walter de Gruyter 1997.
- Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer 2001.
- Wriggers, P.: Nonlinear Finite Element Methods. Springer 2008.

T 3.262 Module component: Novel Actuators and Sensors [T-MACH-102152]

Coordinators: Prof. Dr. Manfred Kohl
Dr. Martin Sommer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	4

Courses					
WT 25/26	2141865	Novel actuators and sensors	2 SWS	Lecture / 🗣	Kohl, Sommer
Exams					
ST 2025	7600010	Novel Actuators and Sensors			Kohl
ST 2025	76-T-MACH-102152	Novel Actuators and Sensors			Sommer, Kohl
WT 25/26	76-T-MACH-102152	Novel Actuators and Sensors			Kohl, Sommer

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam, 60 minutes

Prerequisites
T-MACH-114036 must not be started

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Novel actuators and sensors

2141865, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Literature
- Vorlesungsskript "Neue Aktoren" und Folienskript "Sensoren"
- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007
- "Sensors Update", Edited by H.Baltes, W. Göpel, J. Hesse, VCH, 1996, ISBN: 3-527-29432-5
- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

T 3.263 Module component: Nuclear Fusion Technology [T-MACH-110331]

Coordinators: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Expansion	Version
Oral examination	4 CP	graded	1 semesters	1

Courses					
WT 25/26	2189920	Nuclear Fusion Technology	2 SWS	Lecture / 🗣	Badea
Exams					
WT 25/26	76-T-MACH-110331	Nuclear Fusion Technology			Badea

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 20 min.

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Nuclear Fusion Technology

2189920, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of the physics of fusion, the components of a fusion reactor and their functions. The technological requirements for using fusion technology for future commercial production of electricity and the related environmental impact are also addressed. The students are capable of giving technical assessment of the usage of the fusion energy with respect to its safety and sustainability. The students are qualified for further training in fusion energy field and for research-related professional activity.

- nuclear fission & fusion
- neutronics for fusion
- fuel cycles, cross sections
- gravitational, magnetic and inertial confinement
- fusion experimental devices
- energy balance for fusion systems; Lawson criterion and Q-factor
- materials for fusion reactors
- plasma physics, confinement
- plasma heating
- timeline of the fusion technology
- ITER, DEMO
- safety and waste management

T 3.264 Module component: Nuclear Power and Reactor Technology [T-MACH-110332]

Coordinators: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Expansion	Version
Oral examination	4 CP	graded	1 semesters	1

Courses					
WT 25/26	2189921	Nuclear Power and Reactor Technology	3 SWS	Lecture / 🗣	Badea
Exams					
WT 25/26	76-T-MACH-110332	Nuclear Power and Reactor Technology			Badea

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 20 min.

Prerequisites
None

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Nuclear Power and Reactor Technology

2189921, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of reactor technology and of the major physical processes in converting nuclear power into electrical energy. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. The students are capable of understanding the advantages and disadvantages of different reactor technologies - LWR, heavy water reactors, nuclear power systems of generation IV -by using the delivered knowledge on reactor physics, thermal-hydraulics, reactor design, control, safety and requirements of the front-end and back-end of the fuel cycle. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei, enrichment, neutron flux, cross section, reaction rate, mean free path,
- chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution,
- power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

T 3.265 Module component: Nuclear Power Plant Technology [T-MACH-105402]

Coordinators: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2170460	Nuclear Power Plant Technology	2 SWS	Lecture / 🗣	Cheng, Schulenberg
Exams					
ST 2025	76-T-MACH-105402	Nuclear Power Plant Technology			Cheng, Schulenberg

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, Duration: approximately 30 minutes
no tools or reference materials may be used during the exam

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Nuclear Power Plant Technology

2170460, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in nuclear power plant engineering. The participants can describe the most important components of nuclear power plants and their function. You can design or modify nuclear power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of core design, design of primary and secondary systems, and of nuclear safety technologies. Based on the acquired knowledge in thermodynamics and neutron physics, they can describe and analyze the specific behavior of the nuclear power plant components and assess risks. Participants of the lecture have a trained analytical thinking and judgment in the design of nuclear power plants.

Power plants with pressurized water reactors:

Design of the pressurized water reactor

- Fuel assemblies
- Control rods and drives
- Core instrumentation
- Reactor pressure vessel and its internals

Components of the primary system

- Primary coolant pumps
- Pressurizer
- Steam generator
- Water make-up system

Secondary system:

- Turbines
- Reheater
- Feedwater system
- Cooling systems

Containment

- Containment design
- Components of safety systems
- Components of residual heat removal systems

Control of a nuclear power plant with PWR

Power plants with boiling water reactors:

Design of the boiling water reactor

- Fuel assemblies
- Control elements and drives
- Reactor pressure vessel and its internals

Containment and components of safety systems

Control of a nuclear power plant with boiling water reactors

Literature
Vorlesungsmanuskript

T 3.266 Module component: Numerical Fluid Mechanics [T-MACH-105338]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Davide Gatti

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	4

Courses					
WT 25/26	2153441	Numerical Fluid Mechanics	4 SWS	Lecture / Practice (/	Gatti
Exams					
ST 2025	76-T-MACH-105338	Numerical Fluid Mechanics			Gatti, Frohnapfel

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

Assessment
oral exam - 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Numerical Fluid Mechanics

2153441, WS 25/26, 4 SWS, Language: German, Open in study portal

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

Content
The course covers the following topics:

1. basic equations of computational fluid dynamics
2. main discretization methods for fluid mechanics problems, with focus on finite differences and finite volumes
3. boundary and initial conditions
4. mesh generation and mesh treatment
6. solution algorithms for linear and nonlinear systems of equations
7. solution strategies for the incompressible Navier-Stokes equations
8. introduction to the solution of the compressible Navier-Stokes equations
9. examples of numerical simulation in practice

Literature
Ferziger, Peric: Computational Methods for Fluid Dynamics. Springer-Verlag, 1999.
Hirsch: Numerical Computation of Internal and External Flows. John Wiley & Sons Inc., 1997.
Versteg, Malalasekera: An introduction to computational fluid dynamics. The finite volume method. John Wiley & Sons Inc., 1995

T 3.267 Module component: Numerical Fluid Mechanics with PYTHON [T-MACH-110838]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Davide Gatti

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2154405	Numerical Fluid Mechanics with Python	2 SWS	Practical course / 🔀	Gatti
Exams					
ST 2025	76-T-MACH-110838	Numerical Fluid Mechanics with Python			Frohnapfel, Gatti

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
ungraded homework

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Numerical Fluid Mechanics with Python

2154405, SS 2025, 2 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content
Numerical Fluid Mechanics with Phyton

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

Organizational issues
Die Anmeldung zum Kurs erfolgt durch ILIAS. die Anzahl der KursteilnehmerInnen ist begrenzt. Der Grund dafür ist die Raumgröße und die enge Betreuung, die wir anbieten möchten. Wir bitten also darum, dem ILIAS Kurs nur beizutreten, wenn wirklich Interesse an der Teilnahme besteht!

Literature
H. Ferziger, M. Peric, *Numerische Strömungsmechanik*, Springer-Verlag, ISBN: 978-3-540-68228-8, 2008

E. Laurien, H. Oertel jr, *Numerische Strömungsmechanik*, Vieweg+Teubner Verlag, ISBN: 973-3-8348-0533-1, 2009

T 3.268 Module component: Numerical Mathematics for Students of Computer Science [T-MATH-102242]

Coordinators: Prof. Dr. Andreas Rieder
Dr. Daniel Weiß
Prof. Dr. Christian Wieners

Organisation: KIT Department of Mathematics

Part of: M-MACH-104885 - Courses of the KIT Department of Mathematics

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	4

Courses					
ST 2025	0187400	Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen	2 SWS	Lecture	Wieners
ST 2025	0187500	Übungen zu Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen	1 SWS	Practice	Wieners
Exams					
ST 2025	7700013	Numerical Mathematics for Students of Computer Science			Wieners

Prerequisites
None

T 3.269 Module component: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

Coordinators: Dr. Martin Wörner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2130934	Numerical Modeling of Multiphase Flows	2 SWS	Lecture / 🗣	Wörner
Exams					
ST 2025	76-T-MACH-105420	Numerical Simulation of Multi-Phase Flows			Frohnapfel

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Numerical Modeling of Multiphase Flows

2130934, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Introduction in the subject of multi-phase flows (terms and definitions, examples)
2. Physical fundamentals (dimensionless numbers, phenomenology of single bubbles, conditions at fluid interfaces, forces on a suspended particle)
3. Mathematical fundamentals (governing equations, averaging, closure problem)
4. Numerical fundamentals (discretization in space and time, truncation error and numerical diffusion)
5. Models for interpenetrating continua (homogeneous model, algebraic slip model, standard two-fluid model and its extensions)
6. Euler-Lagrange model (particle equation of motion, particle response time, one-/two-/four-way coupling)
7. Interface resolving methods (volume-of-fluid, level-set and front-capturing method)

Organizational issues
Mündliche Prüfung, Dauer: 30 Minuten, Hilfsmittel: keine

Oral examination (in German or English language), Duration: 30 minutes, Auxiliary means: none

Literature
Ein englischsprachiges Kurzskriptum kann unter https://publikationen.bibliothek.kit.edu/270056199 heruntergeladen werden.

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

Eine Liste mit Buchempfehlungen wird in der ersten Vorlesungsstunde ausgegeben.

T 3.270 Module component: Numerical Simulation of Turbulent Flows [T-MACH-105397]

Coordinators: Dr. Günther Grötzbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2153449	Numerical Simulation of Turbulent Flows	3 SWS	Lecture / 🗣	Grötzbach
Exams					
ST 2025	76-T-MACH-105397	Numerical Simulation of Turbulent Flows			Grötzbach

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral

Duration: 30 minutes

no auxiliary means

Prerequisites
none

Recommendations
Basics in fluid mechanics

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Numerical Simulation of Turbulent Flows

2153449, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The students are qualified to describe the fundamentals of direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent flows. They understand the principle differences between these simulation methods and the respective properties of the conventional turbulence modelling approaches basing on Reynolds Averaged Navier-Stokes equations (RANS). They can describe subgrid scale models, peculiarities of wall and inlet/outlet modelling, suitable numerical solution schemes and evaluation methods. They have obtained the knowledge and understanding required to identify the best modelling approach (among the available methods) for the problem at hand, thus being able to solve given thermal and fluid dynamical problems appropriately.

The lecture series will introduce in following subjects of the turbulence simulation method:

- Appearance of turbulence and deduction of requirements and limits of the simulation method.
- Conservation equations for flows with heat transfer, filtering them in time or space.
- Some subgrid scale models for small scale turbulence and their physical justification.
- Peculiarities in applying boundary and initial conditions.
- Suitable numerical schemes for integration in space and time.
- Statistical and graphical methods to analyse the simulation results.
- Application examples for turbulence simulations in research and engineering

Organizational issues
Dauer der Vorlesung 3 h von 14:00 - 15:30 h und von 15:45 - 16:30 h./Duration of the lecture 3 h from 14:00 - 15:30 h and from 15:45 - 16:30 h

Literature
J. Piquet, *Turbulent Flows – Models and Physics,* Springer, Berlin (2001)

J. Fröhlich, *Large Eddy Simulation turbulenter Strömungen.* Lehrbuch Maschinenbau, B.G. Teubner Verlag, Wiesbaden (2006)

P. Sagaut, C. Meneveau, *Large-eddy simulation for incompressible flows: An introduction.* Springer Verlag (2010)

G. Grötzbach, *Revisiting the Resolution Requirements for Turbulence Simulations in Nuclear Heat Transfer.* Nuclear Engineering & Design Vol. 241 (2011) pp. 4379-4390

G. Grötzbach,Script in English

T 3.271 Module component: Organ Support Systems [T-MACH-105228]

Coordinators: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2106008	Organ support systems	2 SWS	Lecture / 🗣	Pylatiuk
Exams					
ST 2025	76-T-MACH-105228	Organ Support Systems			Pylatiuk

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination (Duration: 60 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Organ support systems

2106008, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction: Definitions and classification of organ support and replacement.
- Special topics: acoustic and visual prostheses, exoskeletons, neuroprostheses, tissue-engineering, hemodialysis, heart-lung machine, artificial hearts, biomaterials.

Learning objectives:

Students have fundamental knowledge about functionality of organ support systems and its components. An analysis of historical developments can be done and limitations of current systems can be found. The limits and possibilities of transplantations can be elaborated.

Organizational issues
Die Vorlesung findet in Präsenz statt.

Literature

- Jürgen Werner: Kooperative und autonome Systeme der Medizintechnik: Funktionswiederherstellung und Organersatz. Oldenbourg Verlag.
- Rüdiger Kramme: Medizintechnik: Verfahren - Systeme – Informationsverarbeitung. Springer Verlag.
- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

T 3.272 Module component: Patent Law [T-INFO-101310]

Coordinators: Patric Werner
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	3

Courses					
ST 2025	24656	Patent Law	2 SWS	Lecture / 🗣	Werner
Exams					
ST 2025	7500109	Patent Law			Sattler
WT 25/26	7500006	Patent Law			Matz

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
None.

Recommendations
None.

T 3.273 Module component: Phase Transformations in Materials [T-MACH-111391]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Each winter term	1 semesters	1

Courses					
WT 25/26	2173421	Phase Transformations in Materials	3 SWS	Lecture / 🗣	Heilmaier, Sen
Exams					
ST 2025	76-T-MACH-111391	Phase Transformations in Materials			Kauffmann
WT 25/26	76-T-MACH-111391	Phase Transformations in Materials			Heilmaier, Sen

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (about 25 min.)

Prerequisites
none

Recommendations
Materials Science and Engineering I/II and some additional fundamentals on thermodynamics and diffusion or Materials Physics and Metals

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Phase Transformations in Materials

2173421, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

Learning objectives:

Students are familiar with a generalized scheme of phase transformations important in materials science and engineering. This includes qualitative and quantitative description of thermodynamics and kinetics of phase transformations. The students are able to apply their fundamental knowledge in order to describe important phase transformations and to deduce properties of materials undergoing these transformations.

Content:

Ch. 0: General Information

Ch. 1: Thermodynamic and Kinetic Fundamentals

- Thermodynamics
- Kinetics
- Overview About Phase Transformations/Schemes

Ch. 2: Experimental Techniques

- General Terms
- Structural Investigations
- Physical Investigations
- Chemical Investigations
- Microstructural Investigations

Ch. 3: Single-Component Systems

- Solidification and Allotropic Transformations
  - Soldification of Elements
    - Nucleation
    - Homogeneous
    - Heterogeneous
    - Growth
      - Temperature-Time-Dependence
      - Facet Energies
      - Facet Growth
      - Heat Transfer (Thermal Dendrites)
  - Allotropic Transformations
    - Nucleation
      - Impact of Elastic Strain Energy
      - Interface Types
    - Growth
      - Temperature-Time-Dependence
- Continuous Phase Transitions

Ch. 4: Multi-Component Systems

- Reconstructive Transformation
  - Solidification of Solid Solutions
  - Spinodal Decomposition
  - Eutectic and Eutectoid Reactions
  - Peritectic and Peritectoid Reactions
  - Precipitation and Ageing
- Displacive Transformation
  - Intermediate Transformations
  - Order Transition
  - Massive Transformation

Work Load

lectures*:* 36 h

private studies*: 64* h

Literature

Powerpoint slides will be distributed via the ILIAS system.

Detailed information are available for different sub topics of the lecture from:

D. A. Porter, K. E. Easterling, M. Y. Sherif: “Phase transformations in metals and alloys”, CRC Press (2009)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

H.K.D.H. Bhadeshia: “Diffusional formation of ferrite in iron and its alloys” in Progress in Materials Science 29 (1985) 321-386
https://doi.org/10.1016/0079-6425(85)90004-0 [currently not available from KIT network but maybe accessed by LEA]

H.K.D.H. Bhadeshia, R.W.K. Honeycomb: “Steels: microstructures and properties”, Butterworth-Heinemann imprint by Elsevier (2017)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC518051110 [free online access from within KIT network]

H.K.D.H. Bhadeshia: “Bainite in steels: transformations, microstructure and properties”, Institute of Materials, London (1992)
https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC030295610

R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland und andere (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/institutes/imw/events/lectures/lecture-notes/physikalische-werkstoffeigenschaften/ [public domain]

T 3.274 Module component: Photovoltaics [T-ETIT-101939]

Coordinators: Prof. Dr.-Ing. Michael Powalla
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2313737	Photovoltaics	3 SWS	Lecture / 🗣	Powalla, Lemmer
ST 2025	2313738	Tutorial 2313737 Photovoltaik	1 SWS	Practice / 🗣	Powalla, Lemmer
Exams					
ST 2025	7313737	Photovoltaics			Powalla, Lemmer

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

Prerequisites
"T-ETIT-100774 - Solar Energy" must not have started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-100774 - Solar Energy must not have been started.

T 3.275 Module component: Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle [T-MACH-105537]

Coordinators: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2189906	Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle	2 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2025	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle			Dagan
WT 25/26	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle			Dagan

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

Assessment
oral exam, approx. 30 min.

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle

Lecture (V) On-Site

2189906, WS 25/26, 2 SWS, Language: German, Open in study portal

Content

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima .
- Fission , chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h
self study 46 h
oral exam about 20 min.

Literature

AEA öffentliche Dokumentation zu den nukleare Ereignissen

K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker: Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

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

R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in Englisch)

J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in Englisch)

T 3.276 Module component: Physical Basics of Laser Technology [T-MACH-102102]

Coordinators: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each winter term	5

Courses					
WT 25/26	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (/	Schneider
Exams					
ST 2025	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider

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

Assessment
oral examination (ca. 25-30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this module component with Laser Material Processing [T-MACH-112763], Laser Application in Automotive Engineering [T-MACH-105164] or Physical Basics of Laser Technology [T-MACH-109084].

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112763 - Laser Material Processing must not have been started.
2. The module component T-MACH-105164 - Laser in Automotive Engineering must not have been started.

Recommendations
Basic knowledge of physics, chemistry and material science

Additional Information
The course is offered in German.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Physical basics of laser technology

2181612, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- savety aspects

The lecture is complemented by a tutorial.

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

regular attendance: 33,5 hours
self-study: 116,5 hours

The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

Organizational issues
Termine für die Übung werden in der Vorlesung bekannt gegeben!

Literature
M. W. Sigrist: Laser: Theorie, Typen und Anwendungen, 2018, Springer Spektrum

T. Graf: Laser - Grundlagen der Laserstrahlerzeugung 2015, Springer Vieweg

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Materialbearbeitung mit Laser, 2023, Springer Vieweg

J. Eichler, H.-J. Eichler: Lasers - Basics, Advances and Applications, 2018, Springer

W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

R. Poprawe, et al.: Tailored Light 1 - High Power Lasers for Production, 2018, Springer

R. Poprawe, et al.: Tailored Light 2 - Laser Applications, 2024, Springer

T 3.277 Module component: Plastic Electronics / Polymerelectronics [T-ETIT-100763]

Coordinators: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2313709	Polymerelectronics/ Plastic Electronics	2 SWS	Lecture / ✕	Hernandez Sosa
Exams					
ST 2025	7313709	Plastic Electronics / Polymerelectronics			Lemmer, Hernandez Sosa

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

Assessment
The control of success takes place within the framework of an oral overall examination (approx. 30 minutes).

Prerequisites
none

Recommendations
Knowledge of semiconductor devices

Additional Information
Lecture and examination are held in German or English, as required.

T 3.278 Module component: Plasticity of Metals and Intermetallics [T-MACH-110818]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Dr. Daniel Schliephake

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each summer term	1

Courses					
ST 2025	2173648	Plasticity of Metals and Intermetallics	4 SWS	Lecture / 🗣	Heilmaier, Schliephake
Exams					
ST 2025	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Heilmaier, Schliephake
ST 2025	76-T-MACH-110818-W	Plasticity of Metals and Intermetallics			Heilmaier, Schliephake
WT 25/26	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Heilmaier, Schliephake

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (about 25 minutes)

Prerequisites
T-MACH-110268 – Plastizität von metallischen und intermetallischen Werkstoffen has not been started

T-MACH-105301 - Werkstoffkunde III has not been started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105301 - Materials Science and Engineering III must not have been started.

Additional Information
The course is offered in English.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Plasticity of Metals and Intermetallics

2173648, SS 2025, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Learning Objectives

Students are familiar with macroscopic, mesoscopic and microscopic mechanisms of plastic deformation in metals, alloys and intermetallics including the qualitative and quantitative descriptions. Furthermore, students can apply their knowledge in order to deduce and explain mechanism-property relationships in this kind of materials and their use in materials manufacturing.

Content

Chapter overview

Ch. 0: General Information
Ch. 1: Relevance of Plasticity in Industry and Research
Ch. 2: Macroscopic Features of Plastic Deformation
Ch. 3: Fundamentals and Interrelations to other Lectures

- Fundamental Concepts of Elasticity
- Macroscopic Strength and Strengthening/Hardening
- Fundamentals of Crystallography
- Fundamentals of Defects in Crystalline Solids

Ch. 4: Dislocations

- Fundamental Concept
- Observation of Dislocations
- Properties of Dislocations
- Dislocations in fcc Metals
- Dislocations in bcc Metals
- Dislocations in hcp Metals and Complex Intermetallics

Ch. 5: Single Crystal Plasticity

- General Stages of Plastic Deformation and Fundamentals of the Stress-Strain curve (fcc Metals)
- Influence of Temperature, Orientation, Strain Rate, etc. (fcc Metals)
- Further Examples (Extension of the Results to bcc, hcp and Intermetallic Materials)
- Deformation Twinning

Ch. 6: Plasticity of Polycrystalline Materials

- Transition from Single Crystals to Polycrystals
- Strength of Polycrystals
    - Solute Atoms
    - Dislocations (incl. Dislocation Patterning)
    - Grain Boundaries (incl. Homogenization of Critical Stress)
    - Precipitates and Dispersoids

Ch. 7: Other Mechanisms of Plastic Deformation

Work Load

lectures: 56 h

private studies: 187 h

Organizational issues
Details about the lecture are distributed via: https://www.iam.kit.edu/wk/english/studies.php

Literature
Powerpoint slides will be distributed via the ILIAS system.

Detailed information are available for different sub topics of the lecture:

P. Hirth, J. Lothe: „Theory of Dislocations“, Krieger (1992)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC070938105

D. Hull, D. J. Bacon: „Introduction to Dislocations“, Elsevier (2011)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC383083990 (free vie KIT license)

R. W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften (public domain)

T 3.279 Module component: Polymer Engineering I [T-MACH-102137]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2173590	Polymer Engineering I	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2025	76-T-MACH-102137	Polymer Engineering I			Liebig
WT 25/26	76-T-MACH-102137	Polymer Engineering I			Liebig

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

Assessment
Oral exam, about 25 minutes

Prerequisites
T-MACH-114007 must not have been started

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Polymer Engineering I

2173590, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Economical aspects of polymers
2. Introductiom of mechanical,
chemical end electrical properties
3. Processing of polymers
(introduction)
4. Material science of polymers
5. Synthesis

learning objectives:

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, to equip the students with knowledge and technical skills, and to use the material "polymer" meeting its requirements in an economical and ecological way.

The students

- are able to describe and classify polymers
  based on the fundamental synthesis processing techniques
- can find practical applications for state-of-the-art polymers and manufacturing technologies
- are able to apply the processing techniques, the application of polymers and polymer composites regarding to the basic principles of material science
- can describe the special mechanical, chemical and elctrical prooperties of polymers and correlate these properties to the chemical bindings.
- can define application areas and the limitation in the use of polymers

requirements:
none

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

T 3.280 Module component: Polymer Engineering II [T-MACH-102138]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2174596	Polymer Engineering II	2 SWS	Lecture / 🗣	Liebig
Exams					
ST 2025	76-T-MACH-102138	Polymerengineering II			Liebig
WT 25/26	76-T-MACH-102138	Polymerengineering II			Liebig

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
T-MACH-114007 must not be started.

Recommendations
Knowledge in Polymerengineering I

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Polymer Engineering II

2174596, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Processing of polymers
2. Properties of polymer components
Based on practical examples and components
2.1 Selection of material
2.2 Component design
2.3 Tool engineering
2.4 Production technology
2.5 Surface engineering
2.6 Sustainability, recycling

learning objectives:

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, that the students gather knowledge and technical skills to use the material "polymer" meeting its requirements in an economical and ecological way.

The students

- can describe and classify different processing techniques
  and can exemplify mould design principles based on technical parts.
- know about practical applications and processing of polymer parts
- are able to design polymer parts according to given restrictions
- can choose appropriate polymers based on the technical requirements
- can decide how to use polymers regarding the production, economical and ecological requirements

requirements:
Polymerengineering I
workload:

The workload for the lecture Polymerengineering II is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

Recommended literature and selected official lecture notes are provided in the lecture.

T 3.281 Module component: Polymers in MEMS A: Chemistry, Synthesis and Applications [T-MACH-102192]

Coordinators: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2141853	Polymers in MEMS A: Chemistry, Synthesis and Applications	2 SWS	/	Worgull
Exams					
ST 2025	76-T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications			Rapp, Worgull

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

Assessment
Oral examination

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Polymers in MEMS A: Chemistry, Synthesis and Applications

2141853, WS 25/26, 2 SWS, Language: German, Open in study portal — **Blended (On-Site/Online)**

Organizational issues
Findet als Blockveranstaltung am Semesterende statt.

T 3.282 Module component: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

Coordinators: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2141854	Polymers in MEMS B: Physics, Microstructuring and Applications	2 SWS	Lecture / 🏵	Worgull
Exams					
ST 2025	76-T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications			Worgull

Legend: 🖥 Online, 🏵 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Polymers in MEMS B: Physics, Microstructuring and Applications

2141854, WS 25/26, 2 SWS, Language: German, Open in study portal

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

T 3.283 Module component: Polymers in MEMS C: Biopolymers and Bioplastics [T-MACH-102200]

Coordinators: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2142855	Polymers in MEMS C - Biopolymers and Bioplastics	2 SWS	/	Worgull
Exams					
ST 2025	76-T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics			Worgull, Rapp

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

Assessment
Oral examination

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Polymers in MEMS C - Biopolymers and Bioplastics

2142855, SS 2025, 2 SWS, Language: German, Open in study portal **Blended (On-Site/Online)**

Content
Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.

This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.

Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are "natural glues" and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

Organizational issues
Für weitere Rückfragen, wenden Sie sich bitte an PD Dr.-Ing- Matthias Worgull (matthias.worgull@kit.edu). Eine Voranmeldung ist nicht notwendig.

Literature
Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.

T 3.284 Module component: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

Coordinators: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	3

Exams			
ST 2025	76-T-MACH-105216	Drive Systems Engineering B: Stationary Machinery	Albers, Ott
WT 25/26	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	Ott

Assessment
written examination: 60 min duration

Prerequisites
None

Additional Information
The course is offered in German.

Workload
120 hours

T 3.285 Module component: Practical Course Combustion Technology [T-CIWVT-108873]

Coordinators: Dr.-Ing. Stefan Raphael Harth
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2232060	Practical Course Combustion Technology	3 SWS	Practical course / 🗣	Trimis, Harth
ST 2025	2232321	Laboratory Work in Combustion Technology	3 SWS	Practical course / 🗣	Harth
Exams					
ST 2025	7231401	Practical Course Combustion Technology			Harth

Legend: 💻 Online, 🌐 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites
None

T 3.286 Module component: Practical Course Technical Ceramics [T-MACH-105178]

Coordinators: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	2

Assessment
Colloquium and laboratory report for the respective experiments.

Prerequisites
none

Workload
120 hours

T 3.287 Module component: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

Coordinators: Dr. Arndt Last
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	2

Courses					
ST 2025	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
WT 25/26	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
WT 25/26	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
Exams					
ST 2025	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology			Last

Legend: 🖥 Online, 🌀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Success is assessed in the form of a written examination lasting 60 minutes.

Prerequisites
none

Below you will find excerpts from courses related to this module component:

V Introduction to Microsystem Technology - Practical Course

2143875, SS 2025, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
In the practical training includes ten experiments:

1. X-ray optics
2. UV-lithography + SEM
3. Micro fluid mixer
4. AFM
5. 3D-printing
6. Scattering at chromium-masks
7. Micro moulding
8. SAW-bio sensorics
9. Nano3D-printer - material transfer in thin layers
10. Electro spinning

Each student takes part in only four experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Organizational issues
Das Praktikum findet in den Laboren des IMT am CN statt. Treffpunkt: Bau 301, vor dem Eingang.

Das "Praktikum" ist das selbe wie das "Laborraktikum", nur benotet! Beide mit schriftlicher Klausur.

Wer teilnehmen möchte, muss sich ab 7.7.2025, 8h00 über das Campussystem unter Veranstaltungen (nicht unter Prüfungen!) auf die Warteliste setzen. Die endgültige Entscheidung, ob man teilnehmen kann, erfolgt erst 25.8.2025.

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V **Introduction to Microsystem Technology - Practical Course** **Practical course (P)**
2143875, WS 25/26, 2 SWS, Language: German, Open in study portal **On-Site**

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V **Introduction to Microsystem Technology - Practical Course** **Practical course (P)**
2143877, WS 25/26, 2 SWS, Language: German, Open in study portal **On-Site**

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

T 3.288 Module component: Practical Training in Measurement of Vibrations [T-MACH-105373]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	1

Assessment
Colloquium to each session, 10 out of 10 colloquiums must be passed

Prerequisites
Can not be combined with Experimental Dynamics (T-MACH-105514).

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105514 - Experimental Dynamics must not have been started.

Recommendations
Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations

Additional Information
The course is offered in German.

Workload
120 hours

T 3.289 Module component: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

Coordinators: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture /	Schell
Exams					
ST 2025	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell
WT 25/26	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell

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

Assessment
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Basic principles of powder metallurgical and ceramic processing

2193010, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Literature

- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Cermamic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T 3.290 Module component: Principles of Medicine for Engineers [T-MACH-105235]

Coordinators: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2105992	Principles of Medicine for Engineers	2 SWS	Lecture / 🗣	Pylatiuk
Exams					
ST 2025	76-T-MACH-105235	Principles of Medicine for Engineers			Pylatiuk

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination (Duration: 60 min)

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Principles of Medicine for Engineers

2105992, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction: Definitions of "health" and "disease". History of medicine and paradigm shift towards evidence based medicine and personalized medicine.
- Special topics: nervous system, saltatory conduction, musculoskeletal system, cardio-circulatory system, narcosis, pain, respiratory system, sensory organs, gynaecology, digestive organs, surgery, nephrology, orthopaedics, immune system, genetics.

Learning objectives:

Students have fundamental knowledge about functionality and anatomy of organs within different medical disciplines. The students further know about technical methods in diagnosis and therapy, common diseases, their relevance and costs. Finally the students are able to communicate with medical doctors in a way, in which they prevent misunderstandings and achieve a more realistic idea of each others expectations.

Literature

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

T 3.291 Module component: Principles of Whole Vehicle Engineering [T-MACH-114095]

Coordinators: Dr. Manfred Harrer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	2

Courses					
ST 2025	2114860	Principles of Whole Vehicle Engineering II	1 SWS	/ 🗣	Harrer
WT 25/26	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture / 🗣	Harrer
Exams					
ST 2025	76-T-MACH-114095	Principles of Whole Vehicle Engineering			Harrer
WT 25/26	76-T-MACH-114095	Principles of Whole Vehicle Engineering			Harrer

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
T-MACH-114075 – Grundsätze der PKW-Entwicklung must not be started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114075 - Principles of Whole Vehicle Engineering must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Principles of Whole Vehicle Engineering II

2114860, SS 2025, 1 SWS, Language: English, Open in study portal **On-Site**

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Learning Objectives:

The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Organizational issues
Dates and further information will be published on the homepage of the institute.

Veranstaltung findet als Blockvorlesung statt.

Kann nicht mit der Veranstaltung [2114842] kombiniert werden.

Cannot be combined with lecture [2114842].

Literature
Das Skript zur Vorlesung ist über ILIAS verfügbar.

V Principles of Whole Vehicle Engineering I

Lecture (V)
On-Site

2113851, WS 25/26, 1 SWS, Language: English, Open in study portal

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

Learning Objectives:

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

Organizational issues
You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Termine und nähere Informationen finden Sie auf der Institutshomepage.

Dats and further information will be published on the homepage of the institute.

Kann nicht mit Lehrveranstaltung 2113810 kombiniert werden

Cannot be combined with lecture 2113810.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

T 3.292 Module component: Principles of Whole Vehicle Engineering [T-MACH-114075]

Coordinators: Dr. Manfred Harrer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	2

Courses					
ST 2025	2114842	Principles of Whole Vehicle Engineering II	1 SWS	Block / 🗣	Harrer
WT 25/26	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture / 🗣	Harrer
Exams					
ST 2025	76-T-MACH-114075	Principles of Whole Vehicle Engineering			Harrer
WT 25/26	76-T-MACH-114075	Principles of Whole Vehicle Engineering			Harrer

Legend: 🖥 Online, 🌍 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
T-MACH-114095 - Fundamentals of Automobile Development must not be started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114095 - Principles of Whole Vehicle Engineering must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Principles of Whole Vehicle Engineering II

2114842, SS 2025, 1 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Learning Objectives:

The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Organizational issues
Vorlesung findet als Blockvorlesung statt. Termine werden über die Homepage des Instituts bekannt gegeben.

Kann nicht mit der Veranstaltung [2114860] kombiniert werden.

Cannot be combined with lecture [2114860].

Literature
Skript zur Vorlesung ist über ILIAS verfügbar.

V Fundamentals of Automobile Development I

2113810, WS 25/26, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

Learning Objecitves:

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

Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/Passwoerterllias/

Termine und nähere Informationen finden Sie auf der Institutshomepage.

Kann nicht mit Lehrveranstaltung 2113851 kombiniert werden.

Date and further information will be published on the homepage of the institute.

Cannot be combined with lecture 2113851.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

T 3.293 Module component: Probabilistic Measurement and Estimation [T-MACH-113873]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	4 CP	graded	Each summer term	1 semesters	2

Courses					
ST 2025	2138334	Probabilistic Measurement and Estimation	2 SWS	Lecture / 🗣	Stiller, Steiner
Exams					
ST 2025	76-T-MACH-113878	Probabilistic Measurement and Estimation			Stiller
WT 25/26	76-MACH-113878	Probabilistic Measurement and Estimation			Stiller

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

Assessment
written exam

60 min.

2 DIN A4 Self-created formular sheets allowed

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Probabilistic Measurement and Estimation** — **Lecture (V) On-Site**
2138334, SS 2025, 2 SWS, Language: German, Open in study portal

Content
Lerninhalt (EN)

1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

Lernziele (EN):

The capabilities of modern sensor technology pave the way for novel applications in engineering. Especially digital measurement techniques may be used even in very complex environments and thus have strong impact on technological progress. Stochastic models of measurement processes form the basis for meaningful information processing and provide a valuable tool for engineering. This interdisciplinary lecture addresses students in mechanical engineering and related subjects. The lecture gives an overview of digital technology and stochastics. These areas form the basics of estimation methods that can be embedded elegantly in the theory of state observers. Applications in signal processing for modern environmental perception (video, Lidar, Radar) illustrate the discussed subjects.

Nachweis:

Written exam

60 minutes

Individual sheet of formulas

Arbeitsaufwand:

In total 120h:

Attendance time: 20 h
Self-study: 100 h

Literature
Skript und Foliensatz zur Veranstaltung werden als kostenlose pdf-Dateien bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

Idealerweise haben Sie zuvor 'Grundlagen der Mess- und Regelungstechnik' gehört oder verfügen aus einer Vorlesung anderer Fakultäten über grundlegende Kenntnisse der Mess- und Regelungstechnik und der Systemtheorie.

T 3.294 Module component: Probability Theory and Statistics [T-MATH-109620]

Coordinators: Prof. Dr. Nicole Bäuerle
Dr. rer. nat. Bruno Ebner
Prof. Dr. Vicky Fasen-Hartmann
Prof. Dr. Daniel Hug
PD Dr. Bernhard Klar
Prof. Dr. Günter Last
Prof. Dr. Mathias Trabs
PD Dr. Steffen Winter

Organisation: KIT Department of Mathematics

Part of: M-MACH-104885 - Courses of the KIT Department of Mathematics

Type	Credits	Grading	Version
Written examination	5 CP	graded	7

Exams			
ST 2025	00007	Probability Theory and Statistics	Trabs, Ebner, Winter

Assessment
Written exam (90 min.)

T 3.295 Module component: Process Simulation in Forming Operations [T-MACH-105348]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2161501	Process Simulation in Forming Technology	2 SWS	Lecture / 🗣	Helm

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

Assessment
oral exam, 20 min.

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Process Simulation in Forming Technology

2161501, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Based on basics of continuum mechanics, material theory and numerics the lecture gives an introduction into the simulation of forming operations for metals

- plasticity for metallic materials: dislocations, twinning, phase transformations, aniostropy, hardening
- classification of forming operations and discussion of selected topics
- basics of tensor algebra and tensor analysis
- continuum mechanics: kinematics, finite deformations, balance laws, thermdydnamics
- material theory: basics, modelling concepts, plasticity and visco plasticity, yield functions (von Mises, Hill, ...), kinematic and isotropic hardening, damage
- thermomechanical coupling
- modelling of contact
- finite element method: explicit and implicite formulations, types of elements, numerical integration of material models
- process simulation of selected problems of sheet metal forming

Organizational issues
In Abstimmung mit den Teilnehmenden ist auch Deutsch als Sprache der Lehrveranstaltung möglich

T 3.296 Module component: Product and Innovation Management [T-WIWI-109864]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	3

Assessment
The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. Further details will be announced during the lecture.

Prerequisites
None

Additional Information
For further information, please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

T 3.297 Module component: Product- and Production-Concepts for Modern Automobiles [T-MACH-110318]

Coordinators: Dr. Stefan Kienzle
Dr. Dieter Steegmüller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2149670	Product- and Production-Concepts for modern Automobiles	2 SWS	Lecture /	Steegmüller, Kienzle

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

Assessment
Oral Exam (20 min)

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

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Product- and Production-Concepts for modern Automobiles

2149670, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Content
The lecture illuminates the practical challenges of modern automotive engineering. As former leaders of the automotive industry, the lecturers refer to current aspects of automotive product development and production.

The aim is to provide students with an overview of technological trends in the automotive industry. In this context, the course also focuses on changes in requirements due to new vehicle concepts, which may be caused by increased demands for individualisation, digitisation and sustainability. The challenges that arise in this context will be examined from both a production technology and product development perspective and will be illustrated with practical examples thanks to the many years of industrial experience of both lecturers.

The topics covered are:

- General conditions for vehicle and body development
- Integration of new drive technologies
- Functional requirements (crash safety etc.), also for electric vehicles
- Development Process at the Interface Product & Production, CAE/Simulation
- Energy storage and supply infrastructure
- Aluminium and lightweight steel construction
- FRP and hybrid parts
- Battery, fuel cell and electric motor production
- Joining technology in modern car bodies
- Modern factories and production processes, Industry 4.0.

Learning Outcomes:

The students …

- are able to name the presented general conditions of vehicle development and are able to discuss their influences on the final product using practical examples.
- are able to name the various lightweight approaches and identify possible areas of application.
- are able to identify the different production processes for manufacturing lightweight structures and explain their functions.
- are able to perform a process selection based on the methods and their characteristics.

Workload:

regular attendance: 25 hours
self-study: 95 hours

Organizational issues
Termine werden über Ilias bekannt gegeben.

Bei der Vorlesung handelt es sich um eine Blockveranstaltung. Eine Anmeldung über Ilias ist erforderlich.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt.

The lecture is a block course. An application in Ilias is mandatory.

The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

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

T 3.298 Module component: Product Development - Dimensioning of Components [T-MACH-105383]

Coordinators: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each summer term	1

Courses					
ST 2025	2150511	Product Development - Component Dimensioning	4 SWS	Lecture / Practice (/ 🗣	Schulze, Dietrich
Exams					
ST 2025	76-T-MACH-105383	Product Development - Dimensioning of Components			Schulze
WT 25/26	76-T-MACH-105383	Product Development - Dimensioning of Components			Schulze

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

Assessment
written exam (2 hours)

Prerequisites
none

Additional Information
Die Lehrveranstaltung wird in deutscher Sprache angeboten.

Workload
210 hours

Below you will find excerpts from courses related to this module component:

V Product Development - Component Dimensioning

2150511, SS 2025, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
The aim of the lecture is to present the topics of the dimensioning and the material science in their connection and to learn how to deal with corresponding methods and the combination thereof.

For the prospective engineer the most important educational objective is to understand the interaction of these topics while the interplay of the individual material stresses in the component are clarified.

The topics in detail are

Structural dimensioning: basic stresses, superimposed stresses, notch influence, fatigue limit, fatigue strength, assessment of cracked components, operational strength, residual stresses, high temperature stress and corrosion

Material selection: Basics, material indices, material selection diagrams, Ashby procedure, multiple boundary conditions, target conflicts, shape and efficiency.

Learning target: The students…

are capable to design and dimension components according to their load.

can include mechanical material properties from the mechanical material test in the dimensioning process.

can identify superimposed total loads and critical loads on simple components and to compute them.

acquire the skill to select materials based on the application area of the components and respective loads.

Examination: written exam (2 hours)

Organizational issues
Freitags generell nach Vereinbarung

Literature
Vorlesungsskript

T 3.299 Module component: Production Operations Management [T-MACH-110327]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	3118031	Production Operations Management	3 SWS	Lecture / Practice (/ 🗣	Furmans, Lanza
Exams					
ST 2025	76-T-MACH-110327	Production Operations Management (MEI)			Furmans, Lanza

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (duration: 90 min)

Prerequisites
T-MACH-110326 - Production Operations Management-Project must have been completed successfully.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110326 - Production Operations Management-Project must have been passed.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Production Operations Management

3118031, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
T-MACH-110326 - Production Operations Management-Project must have been completed successfully when registering for this course.

The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms and sustainability and concepts of circular economy.

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 you own

Attendance time: 25 hours,

Self-study: 65 hours

Organizational issues
Räume werden vom Institut im Ilias-Kurs bekannt gegeben.

T 3.300 Module component: Production Operations Management-Project [T-MACH-110326]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each winter term	1

Courses					
WT 25/26	3118032	Production Operations Management-Project	1 SWS	Project (P / ⛐	Furmans, Lanza

Legend: 🖳 Online, ⛐ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
For solving four case studies as a group work, a maximum of 100 points per case study and student will be awarded. The defense of the case studies will be assessed as an individual contribution with a maximum of 100 points. The maximum score of 500 points corresponds to a grade of 1.0. A detailed evaluation scheme will be provided to the students during the course.

Prerequisites
none

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Production Operations Management-Project

3118032, WS 25/26, 1 SWS, Language: English, Open in study portal

Project (PRO)
Blended (On-Site/Online)

Content
Students are divided into groups for this course. Four case studies will be carried out in these groups. The results of the group work will be presented and evaluated in writing. Prerequisite for the participation in the case study is the previous successful participation in a multiple choice test, which can be repeated online several times in a given period. The result of the group work is presented and evaluated in writing. In addition, selected groups will present and defend their results.

After successful completion of the lecture you will be able to work alone and in a team

- to **name** the treated **technical terms** in the areas of production, logistics and business administration,
- to accurately **describe** the connections between these areas in a discussion with experts,
- to describe **qualitatively** and **quantitatively** the most important decision-making problems in this field,
- to use the corresponding qualitative and quantitative decision models,
- to critically **evaluate** their results and draw conclusions from them,
- as well as to expand the methods and models discussed through **own research**.

The participation of all members of the selected groups in the oral defenses is compulsory and will be controlled. Four written submissions must be passed. For the written submission the group receives a common grade, in the defense each group member is evaluated individually. The defenses are fully included in the grade, but they do not have to be passed in order to pass the entire event. The final score of the event consists of 80% of the written submissions and 20% of the defense evaluation.

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.

Attendance time: 17 hours,

Self-study: 43 hours

Organizational issues
Räume werden vom Institut bekannt gegeben.

T 3.301 Module component: Production Techniques Laboratory [T-MACH-105346]

Coordinators: Prof. Dr.-Ing. Barbara Deml
Prof. Dr.-Ing. Jürgen Fleischer
Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Jivka Ovtcharova

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each summer term	4

Courses					
ST 2025	2110678	Production Techniques Laboratory	4 SWS	Practical course /	Deml, Fleischer, Furmans, Meyer
Exams					
ST 2025	76-T-MACH-105346	Production Techniques Laboratory			Deml, Furmans, Ovtcharova, Schulze

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

Assessment
Active participation in lab course and succesful completion of colloquia before each course. The colloquia are graded.

Additional Information
The course is limited in capacity, therefore the allocation of places is based on § 5 (4) in the Study and Examination Regulations

This results in the following selection criteria:

The selection is based

- on the study progress (here the study progress in credit points and not the study progress in semesters is taken as a basis),
- on the waiting period in the case of equal progress in studies
- by lot if the waiting period is the same.

The procedure is explained in more detail on ILIAS.

Successful participation requires active and continuous participation in the course.

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Production Techniques Laboratory

2110678, SS 2025, 4 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content

The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Information management for I4.0 (IMI)
2. VR-supported product development (IMI)
3. Production of parts with CNC turning machines (wbk)
4. Controlling of production systems using PLCs (wbk)
5. Automated assembly systems (wbk)
6. Flexible material flow in the age of Industry 4.0 (IFL)
7. Identification in production and logistics (IFL)
8. Storage and order-picking systems (IFL)
9. Production Management (ifab)
10. Time study (ifab)
11. Accomplishment of workplace design (ifab)

Recommendations:

Participation in the following lectures:

- Informationssystems in logistics and supply chain management
- Material flow in logistic systems
- Manufacturing technology
- Human Factors Engineering

Learning Objects:

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

After completion this lab, the students are able

- to analyse and solve planning and layout problems of the discussed fields,
- to evaluate and configure the quality and efficiency of production, processes and products,
- to plan, control and evaluate the production of a production enterprise,
- to configure and evaluate the IT architecture of a production enterprise,
- to design and evaluate appropriate techniques for conveying, handling and picking within a production system,
- to design and evaluate the part production and the assembly by considering the work processes and the work places.

Organizational issues

Anwesenheitspflicht, Teilnehmerzahl begrenzt. Anmeldung über ILIAS

Arbeitsaufwand von 120 h (=4 LP).

Nachweis: **bestanden / nicht bestanden**

Regelmäßige Teilnahme an Praktikumsversuchen und erfolgreiche Eingangskolloquien.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten unterstützt.

Literature

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

T 3.302 Module component: Productivity Management in Production Systems [T-MACH-105523]

Coordinators: apl. Prof. Dr. Sascha Stowasser
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2110046	Productivity Management in Production Systems	3 SWS	/ 🗣	Stowasser
Exams					
ST 2025	76-T-MACH-105523	Productivity Management in Production Systems			Stowasser

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

Additional Information
The course is capacity-limited, therefore the **allocation of places** is based on § 5 para. 4 in the module handbook: **Registration and admission to module examinations and courses** . This results in the following selection criteria:

- Students of the degree program have priority over students from outside the degree program

- Among students within the degree program, a decision may be made based on academic progress (not just with subject semesters)
- In the case of equal academic progress according to waiting time
- In the case of equal waiting time by lot

The exact procedure is explained on **ILIAS**.

"Successful participation requires active and continuous participation in the course.

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Productivity Management in Production Systems

2110046, SS 2025, 3 SWS, Language: German, Open in study portal **On-Site**

Content

1. Definition and terminology of process design and industrial engineering
2. Tasks of industrial engineering
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)
4. Methods and principles of industrial engineering and production systems
5. Case studies and exercises for process design
6. Industry 4.0

Requirements:

- Compact course (one week full-time)
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

Recommendations:

- Knowledge of work science is helpful

Learning objective:

- Ability to design work operations and processes effecitvely and efficiently
- Instruction in methods of time study (MTM, Data acquisition etc.)
- Instruction in methods and principles of process design
- The Students are able to apply methods for the design of workplaces, work operations and processes.
- The Students are able to apply actual approaches of process and production organisation.

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

T 3.303 Module component: Project Report Water Distribution Systems [T-BGU-108485]

Coordinators: Dr.-Ing. Peter Oberle
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each winter term	1 semesters	2

Courses					
WT 25/26	6222905	Water Distribution Systems	4 SWS	Lecture / Practice (/	Oberle

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

Assessment
project report, appr. 15 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Additional Information
none

Workload
60 hours

T 3.304 Module component: Project work [T-MACH-110106]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104840 - Project

Type	Credits	Grading	Term offered	Version
Final Thesis	20 CP	graded	Each term	1

Assessment
The Project work work consists of a written report of a scientific subject chosen by the student himself/herself or given by the supervisor. The Project work 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.

Prerequisites
none

Final Thesis
This module component represents a final thesis. The following periods have been supplied:

Submission deadline	6 months
Maximum extension period	1 months
Correction period	6 weeks

Workload
600 hours

T 3.305 Module component: Project Workshop: Automotive Engineering [T-MACH-102156]

Coordinators: Dr.-Ing. Michael Frey
Dr.-Ing. Martin Gießler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each term	1

Courses					
ST 2025	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / 🗣	Gießler, Frey
WT 25/26	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture / 🗣	Gießler, Frey
Exams					
ST 2025	76-T-MACH-102156	Project Workshop: Automotive Engineering			Gießler

Legend: 💻 Online, 🌀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Project Workshop: Automotive Engineering

2115817, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Learning Objectives:

The students are familiar with typical industrial development processes and working style. They are able to apply knowledge gained at the university to a practical task. They are able to analyze and to judge complex relations. They are ready to work self-dependently, to apply different development methods and to work on approaches to solve a problem, to develop practice-oriented products or processes.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, die Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.

Raum und Termine: s. Aushang bzw. Homepage

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

Skripte werden beim Start-up Meeting ausgegeben.

V Project Workshop: Automotive Engineering

Lecture (V)
On-Site

2115817, WS 25/26, 3 SWS, Language: German, Open in study portal

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Learning Objectives:

During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, in deutscher Sprache. Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.
Termin und Raum: siehe Institutshomepage.

Limited number of participants with selection procedure, in German language. Please send the application at the end of the previous semester

Date and room: see homepage of institute.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

Skripte werden beim Start-up Meeting ausgegeben.

The scripts will be supplied in the start-up meeting.

T 3.306 Module component: Python Algorithms for Vehicle Technology [T-MACH-110796]

Coordinators: Stephan Rhode
Organisation:
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2114862	Python Algorithms for Automotive Engineering	2 SWS	Lecture / 🧩	Rhode
Exams					
ST 2025	76-T-MACH-110796	Python Algorithm for Vehicle Technology			Rhode
WT 25/26	76-T-Mach-110796	Python Algorithm for Vehicle Technology			Rhode

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written Examination

Duration: 90 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Python Algorithms for Automotive Engineering

2114862, SS 2025, 2 SWS, Language: German, Open in study portal

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

Content
Teaching content:

- Introduction to Python and useful tools and libraries for creating algorithms, graphical representation, optimization, symbolic arithmetic and machine learning
  - Anaconda, Pycharm, Jupyter
  - NumPy, Matplotlib, SymPy, Scikit-Learn
- Methods and tools for creating software
  - Version management GitHub, git
  - Testing software pytest, Pylint
  - Documentation Sphinx
  - Continuous Integration (CI) Travis CI
  - Workflows in Open Source and Inner Source, Kanban, Scrum
- Practical programming projects to:
  - Road sign recognition
  - Vehicle state estimation
  - Calibration of vehicle models by mathematical optimization
  - Data-based modelling of the powertrain of an electric vehicle

Objectives:

The students have an overview of the programming language Python and important Python libraries to solve automotive engineering problems with computer programs. The students know current tools around Python to create algorithms, to apply them and to interpret and visualize their results. Furthermore, the students know
basics in the creation of software to be used in later programming projects in order to develop high-quality software solutions in teamwork. Through practical programming projects (road sign recognition, vehicle state estimation, calibration, data-based modelling), the students can perform future complex tasks from the area of driver assistance systems.

Organizational issues
Die Vorlesung beginnt mit zwei Kick-Off Veranstaltung in Präsenz am 25.04. sowie am 09.05.2025 um 11:30 Uhr am Campus Ost, Geb.70.04, Raum 219. Die restlichen Termine finden überwiegend digital statt. Weitere Infos über ILIAS.

Literature

- A Whirlwind Tour of Python, Jake VanderPlas, Publisher: O'Reilly Media, Inc. Release Date: August 2016, ISBN: 9781492037859 link
- Scientific Computing with Python 3, Olivier Verdier, Jan Erik Solem, Claus Führer, Publisher: Packt Publishing, Release Date: December 2016, ISBN: 9781786463517 link
- Introduction to Machine Learning with Python, Sarah Guido, Andreas C. Müller, Publisher: O'Reilly Media, Inc., Release Date: October 2016, ISBN: 9781449369880, link
- Clean Code, Robert C. Martin, Publisher: Prentice Hall, Release Date: August 2008, ISBN: 9780136083238, link

T 3.307 Module component: Quality Management [T-MACH-102107]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	4

Courses					
WT 25/26	2149667	Quality Management	2 SWS	Lecture /	Lanza, Benfer
Exams					
ST 2025	76-T-MACH-102107	Quality Management			Lanza

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

Assessment
Written Exam (60 min)

Prerequisites
It is not possible to combine this module component with module component Quality Management [T-MACH-112586].

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Quality Management**
2149667, WS 25/26, 2 SWS, Language: German, Open in study portal
Lecture (V)
Blended (On-Site/Online)

Content
Based on the quality philosophies Total Quality Management (TQM) and Six Sigma, the lecture deals with the requirements of modern quality management. Within this context, the process concept of a modern enterprise and the process-specific fields of application of quality assurance methods are presented. The lecture covers the current state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service related quality management. The content is completed with the presentation of certification possibilities and legal quality aspects.

Main topics of the lecture:

- The term "Quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

Learning Outcomes:

The students …

- are capable to comment on the content covered by the lecture.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the lecture to new problems from the context of the lecture.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the lecture for a specific problem.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Vorlesungstermine montags 09:45 Uhr
Übung erfolgt während der Vorlesung

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt:

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

T 3.308 Module component: Rail System Technology [T-MACH-106424]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	4

Courses					
ST 2025	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
WT 25/26	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
ST 2025	76-T-MACH-106424	Rail System Technology			Cichon
WT 25/26	76-T-MACH-106424	Rail System Technology			Cichon

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
writen examination in German language
Duration: 60 minutes
No tools or reference materials may be used during the exam except calculator and dictionary

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Rail System Technology

2115919, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

Organizational issues
schriftliche Prüfung am 27.08.2025

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

V Rail System Technology

2115919, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 3.309 Module component: Rail Vehicle Technology [T-MACH-105353]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	4

Courses					
ST 2025	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
WT 25/26	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
ST 2025	76-T-MACH-105353	Rail Vehicle Technology			Cichon
WT 25/26	76-T-MACH-105353	Rail Vehicle Technology			Cichon

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
writen examination in German language
Duration: approx 60 minutes
No tools or reference materials may be used during the exam except calculator and dictionary

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Rail Vehicle Technology

2115996, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, locomotives, freight wagons

Organizational issues
schriftliche Prüfung am 27.08.2025

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

V

Rail Vehicle Technology

2115996, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: priciples, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck vehicles, locomotives, freight wagons

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 3.310 Module component: Railways in the Transportation Market [T-MACH-105540]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2114914	Railways in the Transportation Market	2 SWS	Block / 🗣	Cichon
Exams					
ST 2025	76-T-MACH-105540	Railways in the Transportation Market			Cichon

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Railways in the Transportation Market** — **Block (B) On-Site**
2114914, SS 2025, 2 SWS, Language: German, Open in study portal

Content
The lecture gives an overview about perspective, challenges and chances of rail systems in the national and European market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Regulation of railways
- Financing and development of rail infrastructure
- Group strategy “Strong Rail” and their building blocks:
  (climate, environment, digitalization, “Strong Rail” in Baden-Württemberg)
- Trends in the transportation market
- Field of actions in transport policy
- Intra- and intermodal competition
- Summary

Learning Objectives:

- To capture the entrepreneurial perspective on transport companies
- To appraise the intra- and intermodal competition
- To understand the regulative determinant
- To reflect trends in transportation market
- To comprehend strategic challenges, chances and fields of actions of transport companies
- To apply intermodal perspective
- To take important key figures of railways and transportation market
- To realize the relevance of sustainability and digitalization

Organizational issues
Die Blockvorlesung „Die Eisenbahn im Verkehrsmarkt" findet am **09./10./11.07.2025 von 9.30 bis 17.00 Uhr** am Campus Ost. Geb. 70.04, R 220 in Präsenz statt. Die Prüfung findet am 05.08.2025 im Geb. 70.04, R 008 in Präsenz statt.

Dozentin: Dr. Clarissa Freundorfer, Konzernbevollmächtigte der Deutsche Bahn AG für das Land Baden-Württemberg

Näheres siehe Homepage http://www.fast.kit.edu/bst/929.php

Literature
keine

T 3.311 Module component: Reactor Safety I: Fundamentals [T-MACH-105405]

Coordinators: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2189465	Reactor Safety I: Fundamentals	2 SWS	Lecture / 🗣	Sanchez-Espinoza
Exams					
ST 2025	76-T-MACH-105405	Reactor Safety I: Fundamentals			Sanchez-Espinoza
WT 25/26	76-T-MACH-105405	Reactor Safety I: Fundamentals			Sanchez-Espinoza

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam about 30 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Reactor Safety I: Fundamentals

2189465, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content
This lecture will be given in English, if required in German

The lecture discuss the fundamental principles and concepts of reactor safety including the methologies for safety assessment and major accidents.

In the lecture, the fundamental principles and concepts of reactor safety are discussed. They facilitate the assessment of the safety status of nuclear power plants and the interpretation of incidents or accidents as such as Chernobyl or Fukushima. Starting with the explanations of the technical safety features of reactor systems, the safety concepts of different reactor types are discussed. The initiation and progression of incidents/accidents as well as the methods for the safety evaluation are also treated in the lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Methods for safety analysis and safety assessment
- Key physical phenomena during severe accidents determining radiological impact
- How to analyse reactor accidents with numerical simulation tools
- Discussion severe accidents e.g. the Fukushima accident

Lernziele

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents

Knowledge in energy technology, nuclear power plants, reactor physics, thermal hydraulic of nuclear reactors is welcomed

regular attendance: 30 h
self-study: 90 h

Zielgruppe: Students of Mechanical Engineering,

oral examination, duration approximately 30 minutes

Organizational issues
Mündliche Prüfung (Oral examination)

Anmeldung im ILIAS (Registration through ILIAS)

Literature

- A. Ziegler, Lehrbuch der Reaktortechnik Band 1 und 2, Springer Verlag, 1986
- D. Smidt, Reaktorsicherheitstechnik. Springer-Verlag Berlin Heidelberg New York. 1979
- D. Smidt, Reaktortechnik, Band 2, Verlag G. Braun, Karlsruhe, 1976

- G. Kessler at al; Risks of Nuclear Energy Technology- Safety Concepts of Light Water Reactors. Springer Verlag 2014.
- B. R. Sehgal; Nuclear Safety in LWR: Severe Accident Phenomenology. Academic Press Elsevier. 2012.
- John C. Lee and Norman J. McCormick.July; Risk and Safety Analysis of Nuclear Systems. 2011
- G. Petrangeli; Nuclear Safety. Elsevier Butterworth-Heinemann. 2006
- J. N. Lillington; Light Water Reactor Safety: The Development of Advanced Models and Codes for Light Water Reactor Safety Analysis. Elsevier 1995.

T 3.312 Module component: Renewable Energy-Resources, Technologies and Economics [T-WIWI-100806]

Coordinators: Prof. Dr. Patrick Jochem
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	8

Courses					
WT 25/26	2581012	Renewable Energy – Resources, Technologies and Economics	2 SWS	Lecture / 🗣	Jochem
Exams					
ST 2025	7981012	Renewable Energy-Resources, Technologies and Economics			Fichtner

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consists of a written exam (60 minutes, in English, answers are possible in German or English) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites
None.

Below you will find excerpts from courses related to this module component:

V Renewable Energy – Resources, Technologies and Economics

2581012, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
1. General introduction: Motivation, Global situation
2. Basics of renewable energies: Energy balance of the earth, potential definition
3. Hydro
4. Wind
5. Solar
6. Biomass
7. Geothermal
8. Other renewable energies
9. Promotion of renewable energies
10. Interactions in systemic context
11. Excursion to the "Energieberg" in Mühlburg

Learning Goals:
The student

- understands the motivation and the global context of renewable energy resources.
- gains detailed knowledge about the different renewable resources and technologies as well as their potentials.
- understands the systemic context and interactions resulting from the increased share of renewable power generation.
- understands the important economic aspects of renewable energies, including electricity generation costs, political promotion and marketing of renewable electricity.
- is able to characterize and where required calculate these technologies.

Organizational issues
Blockveranstaltung, freitags 14:00-17:00 Uhr, 31.10., 14.11., 28.11., 12.12., 09.01., 23.01., 06.02., 20.02.

Literature
Weiterführende Literatur:

- Kaltschmitt, M., 2006, Erneuerbare Energien : Systemtechnik, Wirtschaftlichkeit, Umweltaspekte, aktualisierte, korrigierte und ergänzte Auflage Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg.
- Kaltschmitt, M., Streicher, W., Wiese, A. (eds.), 2007, Renewable Energy: Technology, Economics and Environment, Springer, Heidelberg.
- Quaschning, V., 2010, Erneuerbare Energien und Klimaschutz : Hintergründe - Techniken - Anlagenplanung – Wirtschaftlichkeit München : Hanser, Ill.2., aktualis. Aufl.
- Harvey, D., 2010, Energy and the New Reality 2: Carbon-Free Energy Supply, Eathscan, London/Washington.
- Boyle, G. (ed.), 2004, Renewable Energy: Power for a Sustainable Future, 2nd Edition, Open University Press, Oxford.

T 3.313 Module component: Robotics I - Introduction to Robotics [T-INFO-114190]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424152	Robotics I - Introduction to Robotics	4 SWS	Lecture / 🗣	Asfour, Daab, Hyseni
Exams					
ST 2025	7500218	Robotics I - Introduction to Robotics			Asfour
WT 25/26	7500106	Robotics I - Introduction to Robotics			Asfour

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Prerequisites
none.

Below you will find excerpts from courses related to this module component:

V Robotics I - Introduction to Robotics

2424152, WS 25/26, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture provides an overview of the fundamentals of robotics using the examples of industrial robots, service robots and autonomous humanoid robots. An insight into all relevant topics is given. This includes methods and algorithms for robot modeling, control and motion planning, image processing and robot programming. First, mathematical basics and methods for kinematic and dynamic robot modeling, trajectory planning and control as well as algorithms for collision-free motion planning and grasp planning are covered. Subsequently, basics of image processing, intuitive robot programming especially by human demonstration and symbolic planning are presented.

In the exercise, the theoretical contents of the lecture are further illustrated with examples. Students deepen their knowledge of the methods and algorithms by independently working on problems and discussing them in the exercise. In particular, students can gain practical programming experience with tools and software libraries commonly used in robotics.

Workload:

Lecture with 3 SWS + 1 SWS Tutorial, 6 LP

6 LP corresponds to 180 hours, including

15 * 3= 45 hours attendance time (lecture)

15 * 1= 15 hours attendance time (tutorial)

15 * 6= 90 hours self-study and exercise sheets

30 hours preparation for the exam

Competency Goals:

The students are able to apply the presented concepts to simple and realistic tasks from robotics. This includes mastering and deriving the mathematical concepts relevant for robot modeling. Furthermore, the students master the kinematic and dynamic modeling of robot systems, as well as the modeling and design of simple controllers. The students know the algorithmic basics of motion and grasp planning and can apply these algorithms to problems in robotics. They know algorithms from the field of image processing and are able to apply them to problems in robotics. They are able to model and solve tasks as a symbolic planning problem. The students have knowledge about intuitive programming procedures for robots and know procedures for programming and learning by demonstration.

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) usually lasting 120 minutes.

Module for the bachelor and master courses in Informatics,Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology

Literature
Additional literature:

Fu, Gonzalez, Lee: Robotics - Control, Sensing, Vision, and Intelligence

Russel, Norvig: Artificial Intelligence - A Modern Approach, 2nd. Ed.

T 3.314 Module component: Robotics II - Humanoid Robotics [T-INFO-114152]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400074	Robotics II: Humanoid Robotics	2 SWS	Lecture / 🗣	Asfour, Gao, Krebs
Exams					
ST 2025	7500086	Robotics II: Humanoid Robotics			Asfour
WT 25/26	7500211	Robotics II: Humanoid Robotics			Asfour

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites

- M-INFO-100816 - Robotics II - Learning and planning robots Module must not have been started.
- T-INFO-101391 - Anthropomatics: Humanoid RoboticsPartial work must not have been started.

Recommendations
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

Below you will find excerpts from courses related to this module component:

V Robotics II: Humanoid Robotics

2400074, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture presents current work in the field of humanoid robotics, which deals with the implementation of complex sensorimotor and cognitive abilities. Various methods and algorithm, their advantages and disadvantages, as well as the current state of research are discussed.

The following topics are covered: Applications and real world examples of humanoid robots; biomechanical models of the human body, biologically inspired and data-driven methods of grasping, imitation learning and programming by demonstration; semantic representations of sensorimotor experience as well as cognitive software architectures of humanoid robots

Learning Objectives:

The students have an overview of current research topics in the field of cognitive and learning robotics using the example of humanoid robotics and are able to categorize and assess current developments in the field of cognitive humanoid robotics.

Students are familiar with the main problem areas of cognitive humanoid robotics and are able to develop solutions on the basis of existing research work.

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Workload: 90 h

Recommendations: *Having visited the lectures on Robotics I – Introduction to Robotics and Mechano-Informatics and Robotics is recommended.*

Intended audience: **Module for Mechanical Engineering Master, Mechatronics and Information Technology Master, Electrical Engineering and Information Technology Master**

Literature
Additional literature

Scientific publications on the topic are made available on the lecture website.

T 3.315 Module component: Robotics III - Sensors and Perception in Robotics [T-INFO-114155]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400067	Robotics III - Sensors and Perception in Robotics	2 SWS	Lecture / 🗣	Asfour, Triebel, Hundhausen
Exams					
ST 2025	7500242	Robotics III - Sensors and Perception in Robotics			Asfour
WT 25/26	7500207	Robotics III - Sensors and Perception in Robotics			Asfour

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
none.

Recommendations
Attending the lecture Robotics I – Introduction to Robotics is recommended.

Below you will find excerpts from courses related to this module component:

V Robotics III - Sensors and Perception in Robotics

2400067, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture complements the lecture Robotics I and provides a broad overview of sensors and perception methods used in robotics. The focus is on visual perception, semantic scene interpretation, simultaneous localization and mapping (SLAM) as well as haptic exploration and active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A fundamental distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive). The second part of the lecture focuses on the use of exteroceptive sensors in robotics. The topics include tactile exploration and visual data processing, including the basics of feature extraction, segmentation, semantic scene interpretation, simultaneous localization and mapping (SLAM) as well as haptic exploration and active perception.

Learning Obejctives:

Students can name the main sensor principles used in robotics. They can explain the data flow from physical measurement through digitization to the use of the measured sensor data for feature extraction, state estimation and semantic scene understanding.

Students are able to propose and justify suitable sensor concepts for robotic tasks.

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Module for Mechanical Engineering Master, Mechatronics and Information Technology Master, Electrical Engineering and Information Technology Master, Mechatronics and Information Technology Bachelor

Recommendations: **Having visited the lectures on Robotics I – Introduction to Robotics is recommended.**

Workload: 90 h

Literature
Lecture slides will be provided during the course.

Accompanying literature references regarding the individual topics of the lecture will be provided.

T 3.316 Module component: Safety Engineering [T-MACH-105171]

Coordinators: Hans-Peter Kany
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	2

Courses					
WT 25/26	2117061	Safety Engineering	2 SWS	Lecture / 🗣	Kany
Exams					
ST 2025	76-T-MACH-105171	Safety Engineering			Furmans

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

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

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Safety Engineering

2117061, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Media
Presentations

Learning content
The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

Learning goals
The students are able to:

- Name and describe relevant safety concepts of safety engineering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and European safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

Recommendations
None

Workload
Regular attendance: 21 hours
Self-study: 99 hours

Organizational issues
Termine: siehe ILIAS.

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen

T 3.317 Module component: Scaling in Fluid Dynamics [T-MACH-105400]

Coordinators: apl. Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2154044	Scaling in fluid dynamics	2 SWS	Lecture / 🗣	Bühler
Exams					
ST 2025	76-T-MACH-105400	Scaling in Fluid Dynamics			Bühler

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

Assessment
Oral exam

Duration: 20-30 minutes

No auxiliary means

Prerequisites
none

Recommendations
Fluid Mechanics (T-MACH-105207)

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Scaling in fluid dynamics

2154044, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Introduction
- Similarity rules (examples)
- Dimensional analysis (Pi-theorem)
- Scaling in differential equations
- Scaling in boundary layers
- Self-similar solutions
- Scaling in turbulent shear layers
- Rotating flows
- Magnetohydrodynamic flows

Educational objective: The student can extract non-dimensional number from the characteristic properties of flows. From the insights on scaling laws, the students are qualified to identify the influencing quantities from generic experiments and transfer these to real applications. The students can simplify the governing equations of fluid mechanic appropriately and can interpret the achieved results as a basis for efficient solution strategies.

Literature
G. I. Barenblatt, 1979, Similarity, Self-Similarity, and Intermediate Asymptotics, Plenum Publishing Corporation (Consultants Bureau)

J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun

J. H. Spurk, 1992, Dimensionsanalyse in der Strömungslehre, Springer

T 3.318 Module component: Selected Chapters of the Combustion Fundamentals [T-MACH-105428]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	1

Courses					
ST 2025	2167541	Selected chapters of the combustion fundamentals	2 SWS	Lecture / 🗣	Maas
WT 25/26	2167541	Selected chapters of the combustion fundamentals	2 SWS	Lecture / ✕	Maas

Legend: 💻 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, approx. 20 min

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Selected chapters of the combustion fundamentals

2167541, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Organizational issues
Blockveranstaltung. Termine siehe Schaukasten und Internetseite des Instituts.

Literature
Vorlesungsunterlagen

Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

V Selected chapters of the combustion fundamentals

2167541, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
Cancelled

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Organizational issues
Nach Vereinbarung, siehe Aushang.

Literature
Vorlesungsunterlagen

Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 3.319 Module component: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Coordinators: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2190411	Selected Problems of Applied Reactor Physics and Exercises	2 SWS	Lecture / 🗣	Dagan, Metz
Exams					
ST 2025	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises			Dagan
WT 25/26	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises			Dagan, Metz

Legend: 🖥 Online, 🌍 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 1/2 hour

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Selected Problems of Applied Reactor Physics and Exercises

2190411, SS 2025, 2 SWS, Language: German/English, Open in study portal

Lecture (V)
On-Site

Content

- Nuclear energy and forces
- Radioactive decay
- Nuclear processes
- Fission and the importance of delayed neutrons
- Basics of nuclear cross sections
- Principles of chain reaction
- Static theory of mono energetic reactors
- Introduction to reactor kinetic
- student laboratory

The students

- have solid understanding of the basic reactor physics
- are able to estimate processes of growth and decay of radionuclides; out of it, they can perform dose calculation and introduce their biological hazards
- can calculate the relationship of basic parameters which are needed for a stable reactor operation
- understand important dynamical processes of nuclear reactors.

Regular attendance: 26 h

self study 94 h

oral exam about 30 min.

Literature
K. Wirtz Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, BI- Hochschultaschenbücher 1969

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

T 3.320 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Graded [T-MACH-111687]

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

Part of: M-MACH-106255 - Key Competencies

Type	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each term	1

Assessment
Completed coursework

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the FORUM (formerly ZAK) or at the Sprachenzentrum (SpZ) can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule and second, assign an IQ-achievement via the tab "IQ achievements".

Workload
60 hours

T 3.321 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded [T-MACH-111686]

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

Part of: M-MACH-106255 - Key Competencies

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each term	1

Assessment
Completed coursework

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the FORUM (formerly ZAK) or at the Sprachenzentrum (SpZ) can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule and second, assign an IQ-achievement via the tab "IQ achievements".

Workload
60 hours

T 3.322 Module component: Seminar in Materials Science [T-MACH-100290]

Coordinators: Dr. Patric Gruber
Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	2

Courses					
ST 2025	2178450	Seminar in Materials Science	2 SWS	Seminar / 🗣	Gruber, Wagner
Exams					
ST 2025	76-T-MACH-100290	Seminar in Materials Science			Gruber, Wagner

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Attendance on all seminars

Preparation of an oral talk (meeting with mentor)

Presentation of oral talk

Prerequisites
Materials Physics, Metals, basics in Ceramics

Additional Information
The course is offered in German.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Seminar in Materials Science

2178450, SS 2025, 2 SWS, Language: German, Open in study portal

Seminar (S)
On-Site

Content
Topics in materials science within the framework of the lectures Materials Physics, Metals and Introduction to Ceramics.

The students are able to work target- and resources-oriented on a scientific case in the field of material science under specified conditions. They are able to research and select scientifical and technical informations according to set criteria. The students are able to prepare and present the scientific case in a clear and convincing manner in an oral presentation.

Organizational issues
Die Vorbesprechung zum Seminar findet am 28.04.2025 zum Seminartermin statt.

Literature
Themenspezifisch

T 3.323 Module component: Seminar Novel Concepts for Solar Energy Harvesting [T-ETIT-108344]

Coordinators: Prof. Dr. Bryce Sydney Richards
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each summer term	2

Courses					
ST 2025	2313761	Seminar Novel Concepts for Solar Energy Harvesting	2 SWS	Seminar / 🗣	Paetzold
Exams					
ST 2025	7313761	Seminar Novel Concepts for Solar Energy Harvesting			Paetzold

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The examination consists of a written journal article and an oral presentation of the student's work, both given in English. The overall impression is rated.

Prerequisites
none

T 3.324 Module component: Sensors [T-ETIT-101911]

Coordinators: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2025	2304231	Sensors	2 SWS	Lecture / 🗣	Menesklou
Exams					
ST 2025	7304231	Sensors			Menesklou
WT 25/26	7304231	Sensors			Menesklou

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 3.325 Module component: Simulation of Coupled Systems [T-MACH-105172]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

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

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

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. T-MACH-108888 must have been passed.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

Recommendations

- Knowledge of ProE (ideally in actual version)
- Basic kniwledge of Matlab/Simulink
- Basic knowledge of dynamics of machnies
- Basic knowledge of hydraulics

Additional Information
After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

Content:

- Basics of multi-body and hydralics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

Literature:

Software guide books (PDFs)

Information about wheel-type loader specifications

Workload
120 hours

T 3.326 Module component: Simulation of Coupled Systems - Advance [T-MACH-108888]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Assessment
Preparation of semester report

Prerequisites
none

T 3.327 Module component: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

Coordinators: Prof. Dr.-Ing. Daniel Banuti
Hon.-Prof. Dr. Thomas Schulenberg

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	2 CP	graded	Each summer term	1

Courses					
ST 2025	2170491	Simulator Exercises Combined Cycle Power Plants	2 SWS	Practical course / 🗣	Banuti, Schulenberg
Exams					
ST 2025	76-T-MACH-105445	Simulator Exercises Combined Cycle Power Plants			Banuti

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam (ca. 15 min)

Prerequisites
none

Recommendations
Participation at LV-No. 2170490 "Combined Cycle Power Plants" (T-MACH-105444) is recommended.

Additional Information
The course is offered in English.

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Simulator Exercises Combined Cycle Power Plants

2170491, SS 2025, 2 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. On the basis of the learned fundamentals in thermodynamics, in instrumentation and control engineering, as well as on the basis of the acquired knowledge of design of combined cycle plants, the participants can operate a real combined cycle power plant. This application creates a deeper understanding of the dynamic processes of the power plant, the specific importance of the plant components and the limits of the load capacity of the components. Participants can optimize normal operation and analyze incidents. They can work self-organized and reflexive. They have communicative and organizational skills in teamwork, even under major technical challenges.

Start-up of the power plant from scratch; load changes and shut down; dynamic response of the power plant in case of malfuctions and of sudden load changes; manual operation of selected components.

Organizational issues
Termine zum Simulatorpraktikum werden in der Vorlesung und per ILIAS am Semesterbeginn mit den Studenten vereinbart.

Appointments for the simulator internship are arranged with the students in the lecture and via ILIAS at the beginning of the semester.

Literature
Vorlesungsskript und weitere Unterlagen der Vorlesung Gas- und Dampfkraftwerke.

Slides and other documents of the lecture Combined Cycle Power Plants.

T 3.328 Module component: Solar Energy [T-ETIT-100774]

Coordinators: Prof. Dr. Ulrich Wilhelm Paetzold
Prof. Dr. Bryce Sydney Richards

Organisation: KIT Department of Electrical Engineering and Information Technology

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

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2313745	Solar Energy	3 SWS	Lecture /	Richards, Paetzold
WT 25/26	2313750	Tutorial 2313745 Solar Energy	1 SWS	Practice /	Richards, Paetzold
Exams					
ST 2025	7313745	Solar Energy			Richards, Paetzold

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

Assessment
Type of Examination: written exam

Duration of Examination: 120 Minutes

Modality of Exam: One written exam at the end of each semester.

Prerequisites

- Knowledge of optoelectronics is a prerequisite, e.g. M-ETIT-107146 – Bauelemente der Opto- und Nanoelektronik.
- Students are not allowed to take „T-ETIT-101939 - Photovoltaik" in addition to this one.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-101939 - Photovoltaics must not have been started.

T 3.329 Module component: Solar Thermal Energy Systems [T-MACH-106493]

Coordinators: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	5

Courses					
WT 25/26	2189400	Solar Thermal Energy Systems	2 SWS	Lecture / 🗣	Dagan
Exams					
ST 2025	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan
WT 25/26	76-T-MACH-106493	Solar Thermal Energy Systems			Dagan

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam of about 30 minutes

Prerequisites
none

Recommendations
Literature

1. "Solar Engineering of Thermal Processes", 4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons
2. “Heat Transfer”, 10th Edition, J. P. Holman Mc. Graw Hill publisher
3. “Fundamentals of classical Thermodynamics”, G. Van Wylen & R. E. Sonntag. Published by Wiley &Sons

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Solar Thermal Energy Systems

2189400, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

The course deals with fundamental aspects of solar energy

1. Introduction to solar energy – global energy panorama

2. Solar energy resource-

Structure of the sun, Black body radiation, solar constant, solar spectral distribution

Sun-Earth geometrical relationship

3. Passive and active solar thermal applications.

4. Solar thermal systems- solar collector-types, concentrating collectors, solar towers,

Heat losses, efficiency

5. Selected topics on thermodynamics and heat transfer which are relevant for solar systems.

6. Introduction to Solar induced systems: Wind , Heat pumps, Biomass , Photovoltaic

7. Energy storage

The course deals with fundamental aspects of solar energy. Starting from a global energy panorama the course deals with the sun as a thermal energy source. In this context, basic issues such as the sun's structure, blackbody radiation and solar–earth geometrical relationship are discussed. In the next part, the lectures cover passive and active thermal applications and review various solar collector types including concentrating collectors and solar towers and the concept of solar tracking. Further, the collector design parameters determination is elaborated, leading to improved efficiency. This topic is augmented by a review of the main laws of thermodynamics and relevant heat transfer mechanisms.

The course ends with an overview on energy storage concepts which enhance practically the benefits of solar thermal energy systems.

The students get familiar with the global energy demand and the role of renewable energies learn about improved designs for using efficiently the potential of solar energy gain basic understanding of the main thermal hydraulic phenomena which support the work on future innovative applications will be able to evaluate quantitatively various aspects of the thermal solar systems.

Total 120 h, hereof 30 h contact hours and 90 h homework and self-studies

oral exam about 30 min.

Organizational issues

Die Vorlesung "Thermische Solarenergie" findet ab dem WS 2024/25 nicht mehr statt. Sie wurde zusammengelegt mit der engl. Version "Solar Thermal Energy Systems"

Literature

- "Solar Engineering of Thermal Processes "4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons.
- "Heat Transfer", 10th Edition, P. Holman Mc. Graw Hill publisher.
- "Fundamentals of classical Thermodynamics", G. Van Wylen & R. E. Sonntag. Published by Wiley & Sons

T 3.330 Module component: Solid State Reactions and Kinetics of Phase [T-MACH-107667]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Dr. Christopher Stihl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	4

Courses					
WT 25/26	2193003	Solid State Reactions and Kinetics of Phase Transformations	2 SWS	Lecture / 🗣	Gorr, Stihl

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

Assessment
oral examination (about 30 min)

Prerequisites
The successful participation in Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion is the condition for the admittance to the oral exam in Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion.

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

T-MACH-110927 – Solid State Reactions and Kinetics of Phase has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations must have been passed.

Recommendations
Bacic course in materials science and engineering

Basic course in mathematics

physical chemistry

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Solid State Reactions and Kinetics of Phase Transformations

2193003, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

Oral examination (about 30 min)

Teaching Content:

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

Recommendations:

knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Bacic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

Literature

1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.
4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.

T 3.331 Module component: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

Coordinators: Prof. Dr.-Ing. Andreas Siebe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	3

Courses					
ST 2025	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture /	Siebe
Exams					
ST 2025	76-T-MACH-105696	Strategic product development - identification of potentials of innovative products			Siebe, Albers

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

Assessment
Oral examination in small groups of 3 people and an approximate duration of 45 minutes.

Prerequisites
The precondition of this module componet is the successful processing of a case study (T-MACH-110396): Documentation and presentation of the overall results (15 minutes)

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110396 - Strategic Product Development - Identification of Potentials of Innovative Products - Case Study must have been passed.

Additional Information
The course is offered in German.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Strategic product development - identification of potentials of innovative products

2146198, SS 2025, 2 SWS, Language: German, Open in study portal

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

Content
Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

Organizational issues
Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage

T 3.332 Module component: Strategic Product Development - Identification of Potentials of Innovative Products - Case Study [T-MACH-110396]

Coordinators: Prof. Dr.-Ing. Andreas Siebe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	1 CP	graded	Each summer term	2

Courses					
ST 2025	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture /	Siebe
Exams					
ST 2025	76-T-MACH-110396	Strategic Product Development - Identification of Potentials of Innovative Products - Case Study			Siebe

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

Assessment
Successful processing of a case study(T-MACH-110396): documentation and presentation of the overall results (15 minutes)

Additional Information
The course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Strategic product development - identification of potentials of innovative products

2146198, SS 2025, 2 SWS, Language: German, Open in study portal

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

Content
Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

Organizational issues
Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage

T 3.333 Module component: Structural Analysis of Composite Laminates [T-MACH-105970]

Coordinators: Prof. Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering
Lightweight Design
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2113106	Structural Analysis of Composite Laminates	2 SWS	Lecture / Practice (/	Kärger
Exams					
ST 2025	76-T-MACH-105970	Structural Analysis of Composite Laminates			Kärger

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

Assessment
oral exam, 20 min

Prerequisites
T-MACH-114003, T-MACH-114005 and T-MACH-114460 must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Structural Analysis of Composite Laminates

2113106, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
To reduce fuel consumption and CO2 emissions, lightweight materials such as fiber-reinforced plasics (FRP) are increasingly being used in vehicle construction. The course is dedicated to the calculation of the material and structural behavior of FRP components with the following contents:

- Micromechanics and homogenization of fibre-matrix-composite
- Macromechanical behavior of individual layer
- Behaviour of multilayer laminate
- FE formulations
- Failure criteria
- Damage analysis
- Dimensioning of FRP parts

Aim of this lecture: The students can explain the mechanical correlation between fibre-matrix-configuration and macroscopic material behavior. They are able to formulate the stress-strain / force-strain relation of an individual layer and of a multilayer laminate by approaches of first and higher order. The students can name, evaluate, and apply failure criteria and approaches to model damage progression. They can name and explain simple dimension strategies to design FRP components.

Literature

H. Altenbach, J. Altenbach, and R. Rikards: Einführung in die Mechanik der Laminat- und Sandwichtragwerke. Deutscher Verlag für Grundstoffindustrie, Stuttgart, 1. edition, 1996.

Henning, F.; Moeller, E.: Handbuch Leichtbau: Methoden, Werkstoffe, Fertigung. Carl Hanser Verlag GmbH & Co. KG, 2011

A. Puck: Festigkeitsanalyse von Faser-Matrix-Laminaten, Modelle für die Praxis. Carl Hanser Verlag, München, Wien, 1. edition, 1996.

H. Schürmann: Konstruieren mit Faserverbundwerkstoffen. ISBN 3-540-40283-7. Springer Verlag, 2005.

englischsprachige Literatur:

H. Altenbach, J. Altenbach, W. Kissing; Mechanics of Composite Structural Elements . ISBN 978-3-642-07411-0 Springer-Verlag Berlin Heidelberg, 2004.

E. J. Barbero: Finite Element Analysis of Composite Materials. ISBN: 1-4200-5433-3 . CRC Press, Boca Raton, FL, 1. edition, 2008.

E. J. Barbero: Introduction to Composite Materials Design. CRC Press, Boca Raton, FL, 2. edition, 2011.

E. J. Barbero: Finite Element Analysis of Composite Materials Using Abaqus. ISBN: ISBN: 978-1-46-651661-8 . CRC Press, Boca Raton, FL, 2013.

Isaac M. Daniel, Ori Ishai: Engineering Mechanics of Composite Materials. Oxford Univ Press; ISBN-13: 978-0195150971 , 2. Edition, 2005.

Davila, C. G.; Camanho, P. P.; Rose, C. A.: Failure criteria for FRP laminates. Journal of Composite Materials 39: 323-345, 2005.

Hinton, M. J.; Kaddour, A. S.; Soden, P. D.: A comparison of the predictive capabilities of current failure theories for composite laminates, judged against experimental evidence. Composites Science and Technology 62: 1725-1797, 2002.

Puck, A.; Schürmann, H.: Failure analysis of FRP laminates by means of physically based phenomenological models. Composite Science and Technology 58: 1045-1067, 1998.

Reddy, J. N.: Mechanics of laminated composite plates and shells - Theory and Analysis. USA: CRC Press, Boca Raton, 2004.

Soden, P. D.; Kaddour, A. S.; Hinton, M. J.: Recommendations for designers and researchers resulting from the world-wide failure exercise. Composites Science and Technology 64: 589-604, 2004.

Stephen W. Tsai and J. Daniel D. Melo: Composite Materials Design and Testing. Composites Design Group, 978-0-9860845-1-5 Stanford University , 2015.

T 3.334 Module component: Structural Materials [T-MACH-100293]

Coordinators: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	3

Courses					
WT 25/26	2174580	Structural Materials	4 SWS	Lecture / Practice (/	Guth
Exams					
ST 2025	76-T-MACH-100293	Structural Materials			Guth
WT 25/26	76-T-MACH-100293	Structural Materials			Guth

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

Assessment
Oral exam, about 25 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Structural Materials

2174580, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Lectures and tutorials on the topics:
- basic loading types and superimposed loadings
- high-temperature loading
- influence of notches
- uniaxial, multiaxial and superimposed cyclic loading
- notch fatigue
- structural durability
- impact of residual stresses
- basic principles of materials selection
- dimensioning of components

learning objectives:
The students are able to select materials for mechanical design and to dimension structural components according to the state of the art. They are familiar with the most important engineering materials. They can assess these materials on base of their characteristic properties and and they can match property profiles and requirement profiles. The dimensioning includes complex situations, such as multiaxial loading, notched components, static and dynamic loading, componetns with residual stresses and loading at high homologous temperatures.
requirements:
none
workload:
Precence: 42h
Self study: 138h

T 3.335 Module component: Superconductors for Energy Applications [T-ETIT-110788]

Coordinators: apl. Prof. Dr. Francesco Grilli
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	5 CP	graded	Each winter term	1 semesters	2

Courses					
WT 25/26	2312704	Superconductors for Energy Applications	2 SWS	Lecture / 🗣	Grilli
WT 25/26	2312705	Computer Exercises for 2312704 Superconductors for Energy Applications	1 SWS	Practice / 🗣	Grilli

Legend: 💻 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam approx. 30 minutes.

Prerequisites
A basic knowledge of electromagnetism and thermodynamics is the only requirement. Previous knowledge of superconductivity is not necessary.

"T-ETIT-106970 - Superconducting Materials for Energy Applications" must not be taken.

T 3.336 Module component: Superhard Thin Film Materials [T-MACH-102103]

Coordinators: Prof. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2177618	Superhard Thin Film Materials	2 SWS	Lecture / 🗣	Ulrich
Exams					
ST 2025	76-T-MACH-102103	Superhard Thin Film Materials			Ulrich

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination (ca. 30 Minuten)

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Superhard Thin Film Materials** — **Lecture (V) On-Site**
2177618, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Teaching Content:

Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic Boronnitride

Materials of the system metall-boron-carbon-nitrogen-silicon

regular attendance: 22 hours
self-study: 98 hours

Superhard materials are solids with a hardness higher than 4000 HV 0,05. The main topics of this lecture are modelling, deposition, characterization and application of superhard thin film materials.

Recommendations: none

Organizational issues
Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 28.10.25.

Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 29.10.25.

Literature
G. Kienel (Herausgeber): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.337 Module component: Sustainable Product Engineering [T-MACH-114033]

Coordinators: Dr.-Ing. Karl-Friedrich Ziegahn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2146193	Sustainable Product Engineering	2 SWS	Lecture / 🗣	Ziegahn
Exams					
ST 2025	76-T-MACH-114033	Sustainable Product Engineering			Ziegahn

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
written exam (90 min)

Prerequisites
none

Recommendations
None

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Sustainable Product Engineering

2146193, SS 2025, 2 SWS, Open in study portal

Lecture (V)
On-Site

Content
understanding of sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects

skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products

understanding of product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products

delivery of key skills such as team skills / project / self / presentation based on realistic projects

The goal of the lecture is to convey the main elements of sustainable product development in the economic, social and ecological context.

The students are able to ...

- identify und describe the sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects.
- discuss the skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products.
- understand the product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products.
- develop skills such as team skills / project / self / presentation based on realistic projects.

T 3.338 Module component: System Dynamics and Control Engineering [T-ETIT-101921]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Exams			
ST 2025	7303155	System Dynamics and Control Engineering	Hohmann

Prerequisites
none

T 3.339 Module component: System Integration in Micro- and Nanotechnology I [T-MACH-114552]

Coordinators: apl. Prof. Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2106033	System Integration in Micro- and Nanotechnology I	2 SWS	Lecture / 🗣	Gengenbach

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

Assessment
Oral exam (Duration: 30 min)

Prerequisites
None

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V System Integration in Micro- and Nanotechnology I

2106033, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Content:

- Introduction to system integration (fundamentals)
- Brief introduction to MEMS processes
- Flexures
- Surfaces and plasma processes for surface treatment
- Adhesive bonding in engineering
- Mounting techniques in electronics
- Molded Interconnect devices (MID)
- Functional Printing
- Low temperature cofired ceramics in system integration

Learning objectives:

The students acquire basic knowledge of challenges and system integration technologies from mechanical engineering, precision engineering and electronics.

Literature

- A. Risse, Fertigungsverfahren der Mechatronik, Feinwerk- und Präzisionsgerätetechnik, Vieweg+Teubner Verlag, Wiesbaden, 2012
- M. Madou, Fundamentals of microfabrication and nanotechnology, CRC Press Boca Raton, 2012
- G. Habenicht, Kleben Grundlagen, Technologien, Anwendungen, Springer-Verlag Berlin Heidelberg, 2009
- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013

T 3.340 Module component: System Integration in Micro- and Nanotechnology II [T-MACH-114553]

Coordinators: apl. Prof. Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2105040	System Integration in Micro- and Nanotechnology II	2 SWS	Lecture / 🗣	Gengenbach

Legend: 🖳 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam (Duration: 30 min)

Prerequisites
None

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V System Integration in Micro- and Nanotechnology II

2105040, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Introduction to system integration (novel processes and applications)

Assembly of hybrid microsystems

Packaging processes

Applications:

- Lab-on-chip systems
- Microoptical systems
- Silicon Photonics

Novel integration processes:

- Direct Laser Writing
- Self Assembly

Learning objectives

The students acquire knowledge of novel system integration technologies and their application in microoptic and microfluidic systems.

Literature
N.-T. Nguyen, Fundamentals and Applications of Microfluidics, Artech House

G. T. Reed, Silicon Photonics: An Introduction, Wiley

T 3.341 Module component: Systematic Materials Selection [T-MACH-100531]

Coordinators: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	6

Courses					
ST 2025	2174576	Systematic Materials Selection	3 SWS	Lecture / 🗣	Dietrich
ST 2025	2174577	Excercises in Systematic Materials Selection	1 SWS	Practice / 🗣	Dietrich
Exams					
ST 2025	76-T-MACH-100531	Systematic Materials Selection			Dietrich
WT 25/26	76-T-MACH-100531	Systematic Materials Selection			Dietrich

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out as a written exam of 2 h.

Prerequisites
none

Recommendations
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Systematic Materials Selection

2174576, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are deeloped. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

learning objectives:
The students are able to select the best material for a given application. They are proficient in selecting materials on base of performance indices and materials selection charts. They can identify conflicting objectives and find sound compromises. They are aware of the potential and the limits of hybrid material concepts (composites, bimaterials, foams) and can determine whether following such a concept yields a useful benefit.
requirements:

WiIng SPO 2007 (B.Sc.)

The course Material Science I [21760] has to be completed beforehand.

WiIng (M.Sc.)

The course Material Science I [21760] has to be completed beforehand.

workload:

The workload for the lecture is 120 h per semester and consists of the presence during the lecture (30 h) as well as preparation and rework time at home (30 h) and preparation time for the oral exam (60 h).

Literature
Vorlesungsskriptum; Übungsblätter; Lehrbuch: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

T 3.342 Module component: Systems Engineering for Automotive Electronics [T-ETIT-100677]

Coordinators: Prof. Dr.-Ing. Jürgen Bortolazzi
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2311642	Systems Engineering for Automotive Electronics	2 SWS	Lecture /	Bortolazzi
ST 2025	2311644	Tutorial for 2311642 Systems Engineering for Automotive Electronics	1 SWS	Practice /	Beck
Exams					
ST 2025	7311642	Systems Engineering for Automotive Electronics			Bortolazzi

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

Prerequisites
none

T 3.343 Module component: Technical Design in Product Development [T-MACH-105361]

Coordinators: Dr.-Ing. Markus Schmid
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Assessment
Written exam (60 min)
Only dictionnary is allowed

Additional Information
The course is offered in German.

Workload
120 hours

T 3.344 Module component: Technical Energy Systems for Buildings 1: Processes & Components [T-MACH-105559]

Coordinators: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2157200	Technical energy systems for buildings 1: Processes & components	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2025	76-T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components			Schmidt

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 30 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Technical energy systems for buildings 1: Processes & components

Lecture (V)
On-Site

2157200, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
Introduction to heating and cooling technologies for buildings, solar energy utilization in buildings (solar radiation, solar thermal energy, photovoltaics) and to energy storage in buildings (thermal and electric storage technologies). Topics covered:

- Burners, condensing and non-condensing boilers
- Cogeneration units for use in buildings
- Heat transformation: Fundamentals, vapor compression, absorption, adsorption
- Solar energy: Radiation, solar thermal collectors, photovoltaics
- energy storage in buildings: thermal and electric storage

Learning objectives:

Students know relevant technical components of energy supply systems in buildings (heating and cooling, dehumidification). They know the energy conversion processes associated with these components and can estimate their energy efficiencies as well as the most important factors influencing efficiency.

Students are familiar with the underlying physics (mostly thermodynamics) of the relevant processes. They can derive relevant figures of merit from these principles. They know the degree of technological development for the various processes and components and are aware of current research and development objectives in this field.

Oral exam: about 25 min.
No tools

T 3.345 Module component: Technical Energy Systems for Buildings 2: System Concept [T-MACH-105560]

Coordinators: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2158201	Technical energy systems for buildings 2: System concepts	2 SWS	Lecture / 🗣	Schmidt
Exams					
ST 2025	76-T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept			Schmidt

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, approx. 30 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Technical energy systems for buildings 2: System concepts

2158201, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Introduction of relevant figures of merit for technical energy systems in buildings. Description of different system concepts for energy supply of buildings (heating, cooling, dehumidification) and evaluation according to figures of merit. Systems covered include

- Heat pumps and heat pump systems including combination with solar thermal energy
- cogeneration and trigeneration system (heating, cooling, power)
- Solar thermal systems: Domestic hot water, heating support, cooling and dehumidification
- District heating systems including solar thermal heat
- Photovoltaics and heat pump systems including thermal and battery storage
- Grid-reactive building technology: Smart-Metering, Smart Home, Smart Grid

Learning outcomes:

Students are able to develop system concepts for technical energy systems in buildings and to rationally design such systems. They know the relevant figures of merit for an energy-related as well as an economical or combined evaluation of systems, and know how to employ these figures of merit in sizing systems and components. Students are able to employ plausibility checks and to give rough estimates on building energy concepts and they know which technologies can be combined for highly efficient system combinations.

Workload: 30 hours course attendance, 90 hours self-study

Oral exam appr. 25 minutes

T 3.346 Module component: Technical Thermodynamics and Heat Transfer I [T-MACH-112912]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Each winter term	1 semesters	2

Courses					
WT 25/26	2165501	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture / 🗣	Maas
Exams					
ST 2025	76-T-MACH-112912	Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 25/26	76-T-MACH-112912	Technical Thermodynamics and Heat Transfer I			Maas, Schießl

Legend: 🖥 Online, 🌍 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam; approx. 3hours

Prerequisites
Successful participation in the tutorial (T-MACH-112910 - Tutorial Technical Thermodynamics and Heat Transfer I)

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112910 - Tutorial Technical Thermodynamics and Heat Transfer I must have been passed.

Additional Information
The course is offered in German.

It will be offered for the first time in the winter semester of 2024/2025.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Technical Thermodynamics and Heat Transfer I

2165501, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- System, properties of state
- Absolute temperature, model systems
- 1st law of thermodynamics for resting and moving systems
- Entropy and 2nd law of thermodynamics
- Behavior of real substances described by tables, diagrams and equations of state
- Machine processes
- Mixtures of ideal and real compounds
- Behavior of mixtures
- Moist air

Literature
Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 3.347 Module component: Technology of Steel Components [T-MACH-105362]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2174579	Technology of steel components	2 SWS	Lecture / 🗣	Schulze
Exams					
ST 2025	76-T-MACH-105362	Technology of Steel Components			Schulze

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 25 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Technology of steel components

2174579, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Meaning, Development and characterization of component states
Description of the influence of component state on mechanical properties
Stability of component states
Steel manufacturing
Component states due to forming
Component states due to heat treatments
Component states due to surface hardening
Component states due to machining
Component states due to mechanical surface treatments
Component states due to joining
Summarizing evaluation

learning objectives:
The students have the background to evaluate the influence of manufacture processes on the compound state of metallic compounds. The students can assess the influence and the stability of compound state under mechanical load. The students are capable to describe the individual aspects of interaction of the compound state of steel components due to forming, heat treatment, mechanical surface treatment and joining processes.
requirements:
Materials Science and Engineering I & II
workload:
regular attendance: 21 hours
self-study: 99 hours

Literature
Skript wird in der Vorlesung ausgegeben

VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984

H.-J. Eckstein: Technologie der Wärmebehandlung von Stahl, Deutscher Verlag Grundstoffindustrie, 1977

H.K.D.H. Badeshia, R.W.K. Honeycombe, Steels - Microstructure and Properties, CIMA Publishing, 3. Auflage, 2006

V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005

T 3.348 Module component: Ten Lectures on Turbulence [T-MACH-105456]

Coordinators: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189904	Ten lectures on turbulence	2 SWS	Lecture /	Otic

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

Assessment
oral exam, 20 min

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Ten lectures on turbulence

2189904, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
Contents:

The course is aimed of giving the fundamentals of turbelence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent ows are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear ows and wall-bounded turbulent ows are discussed. Turbulence modelling approaches and simulation methods are introduced.

1 Introduction
2 Turbulent transport of momentum and heat
3 Statistical description of turbulence
4 Scales of turbulent flows
5 Homogeneous turbulent shear flows
6 Free turbulent shear flows
7 Wall-Bounded turbulent flows
8 Turbulence Modelling
9 Reynolds Averaged Navier-Stokes (RANS) Simulation Approach
10 Large Eddy Simulation (LES) Approach

Objectives:

At the completion of this course, students
- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling
- are able to derive RANS and LES transport equations
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems.
- able to formulate an own turbulence model and implement it into the opensource computational fluid dynamics software OpenFOAM.

Literature
Reference texts:
- Lecture Notes
- Presentation slides

Recommended Books:
- Pope, S. B.: Turbulent Flows. Cambridge University Press, 2003.
- Hinze J. O.: Turbulence. McGraw-Hill, 1975.

T 3.349 Module component: Theory of Probability [T-ETIT-101952]

Coordinators: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each winter term	1

Courses					
WT 25/26	2310505	Theory of Probability	2 SWS	Lecture /	Jäkel, Rost
WT 25/26	2310507	Tutorial for 2310505 Theory of Probability	1 SWS	Practice /	Jäkel
WT 25/26	2310508	Tutorial for 2310505 Theory of Probability	0 SWS	Tutorial (/	Voigt
Exams					
ST 2025	7310505	Theory of Probability			Jäkel

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

Prerequisites
Contents of higher mathematics are necessary (e.g. M-MATH-101731 und M-MATH-101732).

T 3.350 Module component: Theory of Stability [T-MACH-105372]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2163113	Theory of Stability	2 SWS	Lecture / 🗣	Fidlin
ST 2025	2163114	Theory of Stability (Tutorial)	2 SWS	Practice / 🗣	Fidlin, Suresh Singhal
Exams					
ST 2025	76-T-MACH-105372	Theory of Stability			Fidlin
WT 25/26	76-T-MACH-105372	Theory of Stability			Fidlin

Legend: 🖥 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, 30 min.

Prerequisites
none

Recommendations
Vibration theory, Mathematical Methods of Vibration Theory

Additional Information
The course is offered in German.

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Theory of Stability

2163113, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Basic concepts of stability
- Lyapunov's functions
- Direct lyapunov's methods
- Stability of equilibria positions
- Attraction area of a stable solution
- Stability according to the first order approximation
- Systems with parametric excitation
- Stability criteria in the control theory

Literature

- Pannovko Y.G., Gubanova I.I. Stability and Oscillations of Elastic Systems, Paradoxes, Fallacies and New Concepts. Consultants Bureau, 1965.
- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.

T 3.351 Module component: Thermal Turbomachines I [T-MACH-105363]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	3

Exams			
ST 2025	76-T-MACH-105363	Thermal Turbomachines I	Bauer
ST 2025	76T-Mach-105363-Wdh	Thermal Turbomachines I (for repeater)	Bauer
WT 25/26	76-T-MACH-105363	Thermal Turbomachines I	Bauer
WT 25/26	76-T-MACH-105363-Wdh	Thermal Turbomachines I (for repeaters)	Bauer

Assessment
oral exam, duration 30 min.

Prerequisites
none

Workload
180 hours

T 3.352 Module component: Thermal Turbomachines II [T-MACH-105364]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	2170477	Tutorial - Thermal Turbomachines II	2 SWS	Practice / 🗣	Bauer, Mitarbeiter
ST 2025	2170553	Thermal Turbomachines II (in English)	3 SWS	Lecture / 🗣	Bauer
Exams					
ST 2025	76-T-MACH-105364	Thermal Turbomachines II			Bauer
ST 2025	76T-Mach-105364-Wdh	Thermal Turbomachines II (for repeaters)			Bauer
WT 25/26	76-T-MACH-105364	Thermal Turbomachines II			Bauer
WT 25/26	76-T-MACH-105364-Wdh	Thermal Turbomachines II (for repeaters)			Bauer

Legend: 🖥 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam, duration: 30 min.

Prerequisites
none

Workload
180 hours

Below you will find excerpts from courses related to this module component:

V Thermal Turbomachines II (in English)

2170553, SS 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis

Gas Turbines - Thermodynamic process analysis

Combined cycle and cogeneration processes

Overview of turbomachinery theory and kinematics

Energy transfer process within a turbine stage

Types of turbines (presented through examples)

1-D streamline analysis techniques

3-D flow fields and radial momentum equilibrium in turbines

Compressor stage analysis and future trends in turbomachinery

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

regular attendance: 31,50 h
self-study: 64,40 h

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

Exam:

oral

Duration: approximately 30 min

no tools or reference materials may be used during the exam.

Literature
Vorlesungsskript (erhältlich im Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

T 3.353 Module component: Thermal-Fluid-Dynamics [T-MACH-106372]

Coordinators: Dr. Sebastian Ruck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2189423	Thermal-Fluid-Dynamics	2 SWS	Lecture / 🗣	Ruck
Exams					
ST 2025	76-T-MACH-106372	Thermal-Fluid-Dynamics			Ruck
WT 25/26	76-T-MACH-106372	Thermal-Fluid-Dynamics			Ruck

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam of about 30 minutes

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Thermal-Fluid-Dynamics

2189423, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Content

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Velocity and temperature laws in boundary layers
- Convective heat transfer of external and internal flows
- Heat transfer analogies (Prandtl-, von Kárman, Martinelli,…)
- Methods for enhancing heat transfer
- Strategies and methods for investigation of thermal-hydraulics in R&D

The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. On the basis of the conservation equations and the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, with scaling rules the laminar and turbulent thermal boundary layer equations are introduced. In the following, velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed and the influence of roughness and surface design are shown. Concepts of state-of-the-art turbulence modelling and their applicability for different conditions or different heat transfer fluids (e.g. liquid metals, gas, oil) are described. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Design options to enhance the efficiency and effectiveness of heat exchangers are discussed.

The objectives of the lecture are the fundamentals of thermal-hydraulics for describing and modelling convective fluid flow as occurring in power engineering components. A major objective is the description of the convective heat transfer for external and internal flows. A key issue is the transfer of analytic models and empirical results into “state of the art” computational tools and their validation by advanced experimental methods. Within the scope of the course, the students learn (a) to develop differential equation for thermal-hydraulic problems and to describe the thermal flow field by means of dimensionless parameters, (b) to transfer a real problem to an experiment or computational model, (c) to develop analogies and correlations for heat transfer processes of forced convection, (d) to select adequate computational methods/models, (e) to evaluate and select experiments including measurement techniques with adequate instrumentation for thermal-hydraulic problems and (f) to know design option for an efficient and effective heat exchange.

Attendance time: 21 h
Preparation/follow-up time of lectures, exam preparation: 90h

Oral exam of about 30 min.

Literature
Literaturlisten und Angabe von Fachliteratur werden jeweils in den Vorlesungen genannt. Unterlagen zur Lehrveranstaltung werden online unter http://ilias.studium.kit.edu zu Verfügung gestellt. Handout mit Übungsaufgaben für ausgewählte Themengebiete in den jeweiligen Vorlesungen.

T 3.354 Module component: Thesis (BSc) [T-MACH-110107]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104840 - Project

Type	Credits	Grading	Term offered	Version
Final Thesis	15 CP	graded	Each term	1

Assessment
The Thesis work consists of a written Thesis work and an presentation of a scientific subject chosen by the student himself/ herself or given by the supervisor. The Thesis work 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.

Prerequisites
none

Final Thesis
This module component represents a final thesis. The following periods have been supplied:

Submission deadline	3 months
Maximum extension period	1 months
Correction period	6 weeks

Workload
450 hours

T 3.355 Module component: Thesis (MSc) [T-MACH-109880]

Coordinators: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104840 - Project

Type	Credits	Grading	Term offered	Version
Final Thesis	30 CP	graded	Each term	1

Assessment
The Thesis (MSc) work consists of a written Thesis work and an presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The Thesis work 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.

Prerequisites
none

Final Thesis
This module component represents a final thesis. The following periods have been supplied:

Submission deadline	6 months
Maximum extension period	1 months
Correction period	6 weeks

Workload
900 hours

T 3.356 Module component: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	2178420	Mechanical Properties of Nanomaterials and Microsystems	2 SWS	Lecture / 🗣	Kirchlechner, Gruber, Weygand
Exams					
ST 2025	76-T-MACH-105554	Thin Film and Small-scale Mechanical Behavior			Kirchlechner, Gruber, Weygand

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral exam 30 minutes

Prerequisites
Mutual exclusion with T-MACH-114018

Recommendations
preliminary knowlegde in materials science, physics and mathematics

Additional Information
The course is offered in English.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Mechanical Properties of Nanomaterials and Microsystems

2178420, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

1. Introduction: Application and properties of micro- and nanosystems; Overview on size effects

2. Fundamentals: Dislocation plasticity (definition of a dislocation; dislocation density, mobility, dislocation sources, statistical aspects incl. SSDs and GNDs).

3. Single crystal plasticity: mechanical and microstructure characterization, mechanisms and their size dependence.

4. Interface plasticity: Compatibility, slip transfer mechanisms, expected size effects.

5. Modelling of mechanisms causing size effects in crystals and at grain boundaries, e.g. dislocation dynamics.

6. Thin film materials: synthesis, characterization and mechanical properties.

7. Nanocrystalline materials: Synthesis, outstanding mechanical properties

8. Elektro-mechanical conversion: piezo-resistive, piezo-elektric, elektrostatic, ...

9. Actuation: inverse piezoelectric effect, shape-memory, electromagnetic, …

The students know and understand size and scaling effects in micro- and nanosystems based on the fundamental microstructure mechanisms at play. They can describe the mechanical behavior of nano- and microstructured materials and analyze and explain the origin for the differences compared to classical material behavior. They are able to explain suitable processing routes, experimental characterization techniques and adequate modelling schemes for nano- and microstructured materials. They also understand the relevance of mechanical phenomena in small dimensions and can judge how they determine material processing as well the performance and the design of microsensors and microactuators.

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

Organizational issues

The first lecture will take place on April 30, 2025.

Literature

1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials

T 3.357 Module component: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Coordinators: Prof. Dr.-Ing. Günter Leister
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2114845	Tires and Wheel Development for Passenger Cars	2 SWS	Lecture / 🗣	Leister
Exams					
ST 2025	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars			Leister
WT 25/26	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars			Leister

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

Assessment
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Tires and Wheel Development for Passenger Cars

2114845, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology incuding Design and manifacturing methods, Wheeltesting
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Learning Objectives:

The students are informed about the interactions of tires, wheels and chassis. They have an overview of the processes regarding the tire and wheel development. They have knowledge of the physical relationships.

Organizational issues
Voraussichtliche Termine, nähere Informationen und eventuelle Terminänderungen:

siehe Institutshomepage.

Literature
Manuskript zur Vorlesung

Manuscript to the lecture

T 3.358 Module component: Tractors [T-MACH-105423]

Coordinators: Prof. Dr.-Ing. Marcus Geimer
Hon.-Prof. Dr. Martin Kremmer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2113080	Tractors	2 SWS	/	Kremmer
Exams					
ST 2025	76-T-MACH-105423	Tractors			Geimer
WT 25/26	76-T-MACH-105423	Tractors			Geimer, Kremmer

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

Assessment
The assessment consists of an written exam taking place in the recess period (90 min).

Prerequisites
none

Recommendations
Basic knowledge in mechanical engineering.

Additional Information
Learning Outcomes

After completion of the course the Students know:

- important problems in agritechnological developments
- Customer requirements and their implementation in tractors
- Tractor technology in width and depth

Content

Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle

is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or

special concepts of power trains are one of the topics where tractors are in leading position in technologies. During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Tractors**
2113080, WS 25/26, 2 SWS, Language: German, Open in study portal **On-Site**

Content
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fullfilled with high-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical backround, legal requirements, ways of development, agricultural organizations and the proces of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

basic knowledge in mechanical engineering

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

Organizational issues
Ort/Zeit siehe Institutshomepage

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

T 3.359 Module component: Tribology [T-MACH-105531]

Coordinators: Prof. Dr. Martin Dienwiebel
Prof. Dr.-Ing. Matthias Scherge

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each winter term	2

Courses					
WT 25/26	2181114	Tribology	5 SWS	Lecture / Practice (/	Dienwiebel, Scherge

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

Assessment
oral examination (ca. 40 min)
no tools or reference materials

Prerequisites
admission to the exam only with successful completion of the exercises [T-MACH-109303]

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-109303 - Exercices - Tribology must have been passed.

Recommendations
preliminary knowlegde in mathematics, mechanics and materials science

Additional Information
The course is offered in German.

Workload
240 hours

Below you will find excerpts from courses related to this module component:

V Tribology **Lecture / Practice (VÜ) On-Site**
2181114, WS 25/26, 5 SWS, Language: German, Open in study portal

Content

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

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

The student can

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

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

T 3.360 Module component: Tutorial Computational Continuum Mechanics [T-MACH-112996]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	1 CP	pass/fail	Each summer term	1 semesters	1

Courses					
ST 2025	2162262	Tutorial Computational Continuum Mechanics	2 SWS	Practice / 🗣	Hille, Lalović, Böhlke
Exams					
ST 2025	76-T-MACH-112996	Tutorial Computational Continuum Mechanics			Böhlke

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Successful solution of the homework sheets. Details are announced during the first lecture "Computational Continuum Mechanics".

Prerequisites
none

Additional Information
The corresponding course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Tutorial Computational Continuum Mechanics

2162262, SS 2025, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
See "Computational Continuum Mechanics"

Literature
Siehe "Rechnergestützte Kontinuumsmechanik"

T 3.361 Module component: Tutorial Continuum Mechanics of Solids and Fluids [T-MACH-110333]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	2161253	Tutorial Continuum mechanics of solids and fluids	2 SWS	Practice / 🗣	Gisy, Speichinger, Böhlke

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Successful solution of the homework sheets. Details are announced during the first lecture "Continuum Mechanics of Solids and Fluids".

Prerequisites
None

Recommendations
Knowledge of the contents of the course "Computational Continuum Mechanics" as well as the corresponding tutorial are expected.

Additional Information
The corresponding course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Tutorial Continuum mechanics of solids and fluids

2161253, WS 25/26, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Please refer to the lecture "Continuum mechanics of solids and fluids".

Literature
Siehe Vorlesung " Kontinuumsmechanik der Festkörper und Fluide ".

Please refer to the lecture "Continuum mechanics of solids and fluids".

T 3.362 Module component: Tutorial Engineering Mechanics II [T-MACH-100284]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (written)	0 CP	pass/fail	Each summer term	3

Courses					
ST 2025	2162251	Tutorial Engineering Mechanics II	2 SWS	Practice / 🗣	Klein, Lauff, Böhlke
ST 2025	3162011	Engineering Mechanics II (Tutorial)	2 SWS	Practice / 🗣	Gisy, Lalović, Langhoff
Exams					
ST 2025	76-T-MACH-100284	Tutorial Engineering Mechanics II			Böhlke, Langhoff
ST 2025	76-T-MACH-100284-englisch	Tutorial Engineering Mechanics II			Böhlke, Langhoff

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

Assessment
Successful solution of worksheets. Details are given in the first lecture "Engineering Mechanics II"
Passing this course allows to register to the exam "Engineering Mechanics II" (see T-MACH-100283).

Prerequisites
None

Below you will find excerpts from courses related to this module component:

V Tutorial Engineering Mechanics II

2162251, SS 2025, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture Engineering Mechanics II

Literature
Siehe Vorlesung Technische Mechanik II

V Engineering Mechanics II (Tutorial)

3162011, SS 2025, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Engineering Mechanics II"

Literature
see lecture "Engineering Mechanics II"

T 3.363 Module component: Tutorial Engineering Mechanics III [T-MACH-112909]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	1 CP	pass/fail	Each winter term	1 semesters	1

Courses					
WT 25/26	2161204	Engineering Mechanics III (Tutorial)	2 SWS	Practice / 🗣	Proppe, Mukherjee

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

Assessment
Passing this course allows to register to the exam "Engineering Mechanics III" (see T-MACH-112906).

Prerequisites
none

Additional Information
The course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Engineering Mechanics III (Tutorial)

2161204, WS 25/26, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
In the Tutorial excercises for the corresponding subjects of the lecture are presented. During the tutorial part of the tutorial excercises are presented and instructions for those excercises 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.

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.

T 3.364 Module component: Tutorial Introduction to the Finite Element Method [T-MACH-110330]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each winter term	2

Courses					
ST 2025	2162257	Tutorial Introduction to the Finite Element Method	1 SWS	Practice / 🗣	Lauff, Klein, Langhoff, Böhlke
WT 25/26	2162257	Tutorial Introduction to the Finite Element Method	1 SWS	Practice / 🗣	Lauff, Klein, Langhoff, Böhlke
Exams					
ST 2025	76-T-MACH-110330	Tutorial Introduction to the Finite Element Method			Böhlke, Langhoff

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

Assessment
Successful solution of worksheets. Details are given in the first lecture "Introduction to the finite element method".

Recommendations
Knowledge of the contents of the course "Computational Continuum Mechanics" as well as the corresponding tutorial are expected.

Additional Information
The corresponding course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Tutorial Introduction to the Finite Element Method

2162257, SS 2025, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
See lecture "Introduction to the Finite Element Method"

Literature
siehe Vorlesung "Einführung in die Finite-Elemente-Methode"

V Tutorial Introduction to the Finite Element Method

2162257, WS 25/26, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
See lecture "Introduction to the Finite Element Method"

Literature
siehe Vorlesung "Einführung in die Finite-Elemente-Methode"

T 3.365 Module component: Tutorial Mathematical Methods in Micromechanics [T-MACH-110379]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2162281	Tutorial Mathematical Methods in Micromechanics	1 SWS	Practice / 🗣	Speichinger, Böhlke
Exams					
ST 2025	76-T-MACH-110379	Tutorial Mathematical Methods in Micromechanics			Böhlke

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Successfully solving the homework sheets. Details are given in the first lecture.

Additional Information
The corresponding course is offered in German.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Tutorial Mathematical Methods in Micromechanics

2162281, SS 2025, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Mathematical Methods in Micromechanics"

T 3.366 Module component: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	2

Courses					
ST 2025	2162345	Tutorial in Nonlinear Continuum Mechanics	2 SWS	Practice / 🗣	Böhlke, Gisy

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Successful solution of worksheets. Details are given in the first lecture

Successful participation in this course allows for registration to the Exam "Nonlinear Continuum Mechanics" (see 76-T-MACH-111026)

Prerequisites
none

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description 2162345 "Tutorial in Nonlinear Continuum Mechanics"

Workload
60 hours

Below you will find excerpts from courses related to this module component:

V Tutorial in Nonlinear Continuum Mechanics

2162345, SS 2025, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Nonlinear Continuum Mechanics"

Organizational issues
Die Lehrveranstaltung wird als Blockveranstaltung geplant. Für weitere Informationen wenden Sie sich bitte an das Sekretariat.

Mit Zustimmung aller Teilnehmenden kann die Lehrveranstaltung auch auf Deutsch gehalten werden.

Literature
siehe Vorlesung "Nonlinear Continuum Mechanics"

T 3.367 Module component: Tutorial Technical Thermodynamics and Heat Transfer I [T-MACH-112910]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Expansion	Version
Coursework (written)	1 CP	pass/fail	Each winter term	1 semesters	1

Courses					
ST 2025	2166503	Technical Thermodynamics and Heat Transfer I (Repeater)	2 SWS	Tutorial (/ 🗣	Maas
WT 25/26	2165502	Exercise course Technical Thermodynamics and Heat Transfer I	2 SWS	Practice / 🗣	Maas
WT 25/26	2165503	Tutorial Technical Thermodynamics and Heat Transfer I	2 SWS	Tutorial (/ 🗣	Maas
Exams					
ST 2025	76-T-MACH-112910	Tutorial Technical Thermodynamics and Heat Transfer I			Maas, Schießl
WT 25/26	76-T-MACH-112910	Tutorial Technical Thermodynamics and Heat Transfer I			Maas, Schießl

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

Assessment
Successful completion of written preliminary tests.

Additional Information
The course is offered in German.

It will be offered for the first time in the winter semester of 2024/2025.

Workload
30 hours

Below you will find excerpts from courses related to this module component:

V Technical Thermodynamics and Heat Transfer I (Repeater)

2166503, SS 2025, 2 SWS, Language: German, Open in study portal

Tutorial (Tu)
On-Site

Literature
Vorlesungsskriptum
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 3.368 Module component: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

Coordinators: Dr.-Ing. Thomas Giegerich
Dr. Robin Größle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2190499	Vacuum and Tritium Technology in Nuclear Fusion	2 SWS	/ 🗣	Größle, Giegerich
Exams					
ST 2025	76-T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion			Giegerich, Größle

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
oral examination, approx. 20 Minutes, any time in the year

Prerequisites
none

Recommendations
Knowledge in ´Fusion Technology A´

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Vacuum and Tritium Technology in Nuclear Fusion

2190499, SS 2025, 2 SWS, Language: German/English, Open in study portal **On-Site**

Content
Introduction

Tritium Handling

Tritium Plant Technologies

Tritium and Breeding

Fundamentals of Vacuum Science and Technology

Fusion Vacuum systems

Matter Injection into the Plasma Chamber

Fuel Cycle of ITER and DEMO

The students have acquired the necessary understanding in order to design and size facilities for tritium operation. They understand the process steps in the tritium plant of a fusion reactor for tritium removal and tritium recovery from tritiated exhaust gas. Furthermore, the students have understood the fundamentals of vacuum physics and are able to design and choose vacuum pumps properly.

recommended is Knowledge in "Fusion Technology A"

oral exam of about 20 min

Organizational issues
Anmeldung bis 20. April via E-Mail an: thomas.giegerich@kit.edu

Voraussichtlich 4 Tage in der Pfingstwoche, jeweils 08:00-17:00 Uhr am CN. Raum wird bekanntgegeben.

T 3.369 Module component: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

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

Lightweight Design
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture /	Henning
Exams					
ST 2025	76-T-MACH-114010	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning
WT 25/26	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials			Henning

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

Assessment
Written exam; Duration approx. 90 min

Prerequisites
T-MACH-114001 must not have been started.

Recommendations
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Vehicle Lightweight design – Strategies, Concepts, Materials

2113102, WS 25/26, 2 SWS, Language: German, Open in study portal

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

Content
Strategies in lightweight design
Shape optimization, light weight materials, multi-materials and concepts for lightweight design

Construction methods
Differential, integral, sandwich, modular, bionic

Body construction
Shell, space frame, monocoque

Metalic materials
Steel, aluminium, magnesium, titan

Aim of this lecture:

Students learn that lightweight design is a process of realizing a demanded function by using the smallest possible mass. They understand lightweight construction as a complex optimization problem with multiple boundary conditions, involving competences from methods, materials and production.

Students learn the established lightweight strategies and ways of construction. They know the metallic materials used in lightweight construction and understand the relation between material and vehicle body.

Literature

[1] E. Moeller, *Handbuch Konstruktionswerkstoffe : Auswahl, Eigenschaften, Anwendung*. München: Hanser, 2008.

[2] H.-J. Bargel*, et al.*, *Werkstoffkunde*, 10., bearb. Aufl. ed. Berlin: Springer, 2008.

[3] C. Kammer, *Aluminium-Taschenbuch : Grundlagen und Werkstoffe*, 16. Aufl. ed. Düsseldorf: Aluminium-Verl., 2002.

[4] K. U. Kainer, "Magnesium - Eigenschaften, Anwendungen, Potentiale ", Weinheim [u.a.], 2000, pp. VIII, 320 S.

[5] A. Beck and H. Altwicker, *Magnesium und seine Legierungen*, 2. Aufl., Nachdr. d. Ausg. 1939 ed. Berlin: Springer, 2001.

[6] M. Peters, *Titan und Titanlegierungen*, [3., völlig neu bearb. Aufl.] ed. Weinheim [u.a.]: Wiley-VCH, 2002.

[7] H. Domininghaus and P. Elsner, *Kunststoffe : Eigenschaften und Anwendungen; 240 Tab*, 7., neu bearb. u. erw. Aufl. ed. Berlin: Springer, 2008.

T 3.370 Module component: Vehicle Systems for Urban Mobility [T-MACH-113069]

Coordinators: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Version
Oral examination	4 CP	graded	3

Courses					
ST 2025	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Ziesel, Cichon
WT 25/26	2115922	Vehicle Systems for Urban Mobility	2 SWS	Lecture / 🗣	Cichon, Ziesel
Exams					
ST 2025	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Ziesel, Cichon
WT 25/26	76-T-MACH-106428	Vehicle Systems for Urban Mobility			Ziesel, Cichon

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral examination
Duration: approx. 20 minutes
No tools or reference material may be used during the exam.

Additional Information
The course is offered in German.

Workload
120 hours

T 3.371 Module component: Vibration Theory [T-MACH-105290]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	4

Courses					
WT 25/26	2161212	Vibration Theory	2 SWS	Lecture /	Genda, N.N.
WT 25/26	2161213	Vibration Theory (Tutorial)	2 SWS	Practice /	Genda, N.N.

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

Assessment
written exam, 180 min.

Prerequisites
Engineering Mechanics III comparable basic knowledge of dynamics

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Vibration Theory

2161212, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

Literature
Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd. 1 und Bd. 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

V Vibration Theory (Tutorial)

2161213, WS 25/26, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises related to the lecture

T 3.372 Module component: Virtual Reality Practical Course [T-MACH-102149]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	3

Exams			
ST 2025	76-T-MACH-102149	Virtual Reality Practical Course	Ovtcharova, Häfner

Assessment
Learning control is an examination of another type. The overall impression is evaluated. The following aspects are included in the grading:

- Project work and documentation
- Presentation and demonstration of the project results

The grading scale will be announced in the course.

Prerequisites
None

Additional Information
Number of participants is limited

Workload
120 hours

T 3.373 Module component: Warehousing and Distribution Systems [T-MACH-105174]

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

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	3

Courses					
ST 2025	2118097	Warehousing and distribution systems	2 SWS	Lecture / 🗣	Furmans
Exams					
ST 2025	76-T-MACH-105174	Warehousing and Distribution Systems			Furmans

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites
none

Additional Information
The course is offered in German

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Warehousing and distribution systems

2118097, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
Vorlesung:

Die Vorlesung wird in diesem Semester als **Blockveranstaltung** angeboten. Die Veranstaltungstermine sind:

- Mi., 14. Mai
- Do., 15. Mai
- Fr., 16 Mai

Die Vorlesung startet jeweils um 08:00 Uhr und findet im **Selmayr-HS (Geb. 50.38)** statt. Bitte beachten Sie für mögliche kurzfristige Raumänderungen die Informationen im ILIAS-Kurs.

Die Vorlesung wird von einem externen Dozenten aus Logistikberatung gehalten.

Fokusthemen:

- Grundlagen von Lagerplanung und Intralogistik-Technik
- Je eine Vorlesungseinheit für alle Bereiche eines Lagers
- Praxisbeispiele und Fallstudien
- Übersicht über Logistiknetzwerke und Lean Logistics

Klausur:

- Informationen zur Klausur werden zeitnah über den Ilias-Kurs bekanntgegeben.

Vorlesungsbegleitende Unterlagen:

- Die vorlesungsbegleitenden Unterlagen finden Sie ebenfalls im Ilias-Kurs.

Ansprechpartner:

Keno Büscher

Literature

ARNOLD, Dieter, FURMANS, Kai (2005)
Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag

ARNOLD, Dieter (Hrsg.) et al. (2008)
Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag

BARTHOLDI III, John J., HACKMAN, Steven T. (2008)
Warehouse Science

GUDEHUS, Timm (2005)
Logistik, 3. Auflage, Berlin: Springer-Verlag

FRAZELLE, Edward (2002)
World-class warehousing and material handling, McGraw-Hill

MARTIN, Heinrich (1999)
Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg

WISSER, Jens (2009)
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe : Universitätsverlag

Eine ausführliche Übersicht wissenschaftlicher Paper findet sich bei:

ROODBERGEN, Kees Jan (2007)
Warehouse Literature

T 3.374 Module component: Water Distribution Systems [T-BGU-108486]

Coordinators: Dr.-Ing. Peter Oberle
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Each winter term	1 semesters	2

Courses					
WT 25/26	6222905	Water Distribution Systems	4 SWS	Lecture / Practice (/	Oberle

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

Assessment
oral exam, appr. 30 min.

Prerequisites
The not graded coursework 'Project Report Water Distribution Systems' (T-BGU-108485) has to be passed as examination prerequisite.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-BGU-108485 - Project Report Water Distribution Systems must have been passed.

Recommendations
none

Additional Information
none

Workload
120 hours

T 3.375 Module component: Welding Technology [T-MACH-105170]

Coordinators: Dr.-Ing. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2173571	Welding Technology	2 SWS	Block / 🗣	Farajian

Legend: 💻 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Oral exam, about 20 minutes

Prerequisites
none

Recommendations
Basics of material science (iron- and non-iron alloys), materials, processes and production, design.

All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Welding Technology

2173571, WS 25/26, 2 SWS, Language: German, Open in study portal

Block (B)
On-Site

Content
definition, application and differentiation: welding,

welding processes, alternative connecting technologies.

history of welding technology

sources of energy for welding processes

Survey: Fusion welding,

pressure welding.

weld seam preparation/design

welding positions

weldability

gas welding, thermal cutting, manual metal-arc welding

submerged arc welding

gas-shielded metal-arc welding, friction stir welding, laser beam and electron beam welding, other fusion and pressure welding processes

static and cyclic behavior of welded joints,

fatigue life improvement techniques

learning objectives:

The students have knowledge and understanding of the most important welding processes and its industrial application.

They are able to recognize, understand and handle problems occurring during the application of different welding processes relating to design, material and production.

They know the classification and the importance of welding technology within the scope of connecting processes (advantages/ disadvantages, alternatives).

The students will understand the influence of weld quality on the performance and behavior of welded joints under static and cyclic load.

How the fatigue life of welded joints could be increased, will be part of the course.

requirements:
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

workload:

The workload for the lecture Welding Technology is 120 h per semester and consists of the presence during the lecture (18 h) as well as preparation and rework time at home (102 h).

exam:

oral, ca. 20 minutes, no auxiliary material

Organizational issues
Die Blockveranstaltung findet am 29.01.26, 30.01.2026, 05.02.2026, 06.02.2026 jeweils von 09:00 bis 15:00 Uhr in Gebäude 10.91 Raum 380 statt. Anmeldungen erfolgen über den Beitritt zum ILIAS-Kurs. Bei Fragen wenden Sie sich gerne an majid.farajian@kit.edu

Literature
Für ergänzende, vertiefende Studien gibt das

Handbuch der Schweißtechnik von J. Ruge, Springer Verlag Berlin, mit seinen vier Bänden

Band I: Werkstoffe

Band II: Verfahren und Fertigung

Band III: Konstruktive Gestaltung der Bauteile

Band IV: Berechnung der Verbindungen

einen umfassenden Überblick. Der Stoff der Vorlesung Schweißtechnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweißverfahren bietet das Bändchen

Nies: Lichtbogenschweißtechnik, Bibliothek der Technik Band 57, Verlag moderne Industrie AG und Co., Landsberg / Lech

Im Übrigen sei auf die zahlreichen Fachbücher des DVS Verlages, Düsseldorf, zu allen Einzelgebieten der Fügetechnik verwiesen.

T 3.376 Module component: Wildcard [T-MACH-112701]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106253 - Courses of the KIT Department of Humanities and Social Sciences

Type	Credits	Grading	Term offered	Version
Coursework	15 CP	pass/fail	Each term	1

T 3.377 Module component: Wildcard [T-MACH-112702]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106254 - Courses of the KIT Department of Physics

Type	Credits	Grading	Term offered	Version
Examination of another type	15 CP	graded	Each term	1

T 3.378 Module component: Wildcard [T-MACH-112698]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

Type	Credits	Grading	Term offered	Version
Examination of another type	15 CP	graded	Each term	1

T 3.379 Module component: Wildcard [T-MACH-112697]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106251 - Courses of the KIT Department of Architecture

Type	Credits	Grading	Term offered	Version
Coursework	15 CP	pass/fail	Each term	1

T 3.380 Module component: Wildcard [T-MACH-112696]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106251 - Courses of the KIT Department of Architecture

Type	Credits	Grading	Term offered	Version
Examination of another type	15 CP	graded	Each term	1

T 3.381 Module component: Wildcard [T-MACH-112699]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

Type	Credits	Grading	Term offered	Version
Coursework	15 CP	pass/fail	Each term	1

T 3.382 Module component: Wildcard [T-MACH-112703]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106254 - Courses of the KIT Department of Physics

Type	Credits	Grading	Term offered	Version
Coursework	15 CP	pass/fail	Each term	1

T 3.383 Module component: Wildcard [T-MACH-112700]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106253 - Courses of the KIT Department of Humanities and Social Sciences

Type	Credits	Grading	Term offered	Version
Examination of another type	15 CP	graded	Each term	1

T 3.384 Module component: Windpower [T-MACH-105234]

Coordinators: Norbert Lewald
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	3

Courses					
WT 25/26	2157381	Windpower	2 SWS	Lecture / 🗣	Lewald
Exams					
ST 2025	76-T-MACH-105234	Windpower			Lewald
WT 25/26	76-T-MACH-105234	Windpower			Lewald

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written exam.

Duration: 80 min

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V **Windpower** — **Lecture (V) On-Site**
2157381, WS 25/26, 2 SWS, Language: German, Open in study portal

T 3.385 Module component: Working Methods in Materials Science and Technology [T-MACH-100288]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework (practical)	2 CP	pass/fail	Each term	1

T 3.386 Module component: Workshop Mechatronical Systems and Products [T-MACH-108680]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	5

Courses					
WT 25/26	2145162	Workshop Mechatronical Systems and Products	3 SWS	Practical course / 🗣	Matthiesen, Hohmann, Teltschik

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Alongside the workshop, deliverables will be requested at defined milestones. In these, the application of the knowledge that has been developed within the framework of the module will be examined. These deliverables consist of CAD designs, control software and reflection reports, for example, are defined in a workshop assignment at the beginning of the semester. The milestones are announced in a calendar at the beginning of the semester and are available to students through ILIAS. The demanded deliveries are uploaded to ILIAS.

Prerequisites
none

Additional Information
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " *Anmeldung und Gruppeneinteilung* " in ILIAS before the start of the semester.

The course is offered in German.

Workload
120 hours

T 3.387 Module component: Workshop on Computer-based Flow Measurement Techniques [T-MACH-106707]

Coordinators: Prof. Dr.-Ing. Hans-Jörg Bauer

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	1

Courses					
ST 2025	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / 🗣	Bauer, Mitarbeiter
WT 25/26	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course / 🗣	Bauer, Mitarbeiter

Legend: 💻 Online, 🌸 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Prerequisites
none

Workload
120 hours

Below you will find excerpts from courses related to this module component:

V Workshop on computer-based flow measurement techniques

2171488, SS 2025, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Registration during the lecture period via the website.

The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.

Basic design of measurements systems

- Logging devices and sensors
- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis
-

regular attendance: 52,5
self-study: 67,5

The students are able to:

- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Organizational issues
Der aktuelle Status wird auf der ITS-homepage bekannt gegeben.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

V **Workshop on computer-based flow measurement techniques** — **Practical course (P)**
2171488, WS 25/26, 3 SWS, Language: German, Open in study portal — **On-Site**

Content
Registration during the lecture period via the website.

The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.

Basic design of measurements systems

- Logging devices and sensors
- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis
-

regular attendance: 52,5
self-study: 67,5

The students are able to:

- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Organizational issues
Der aktuelle Status wird auf der ITS-homepage bekannt gegeben.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011