Karlsruher Institut für Technologie

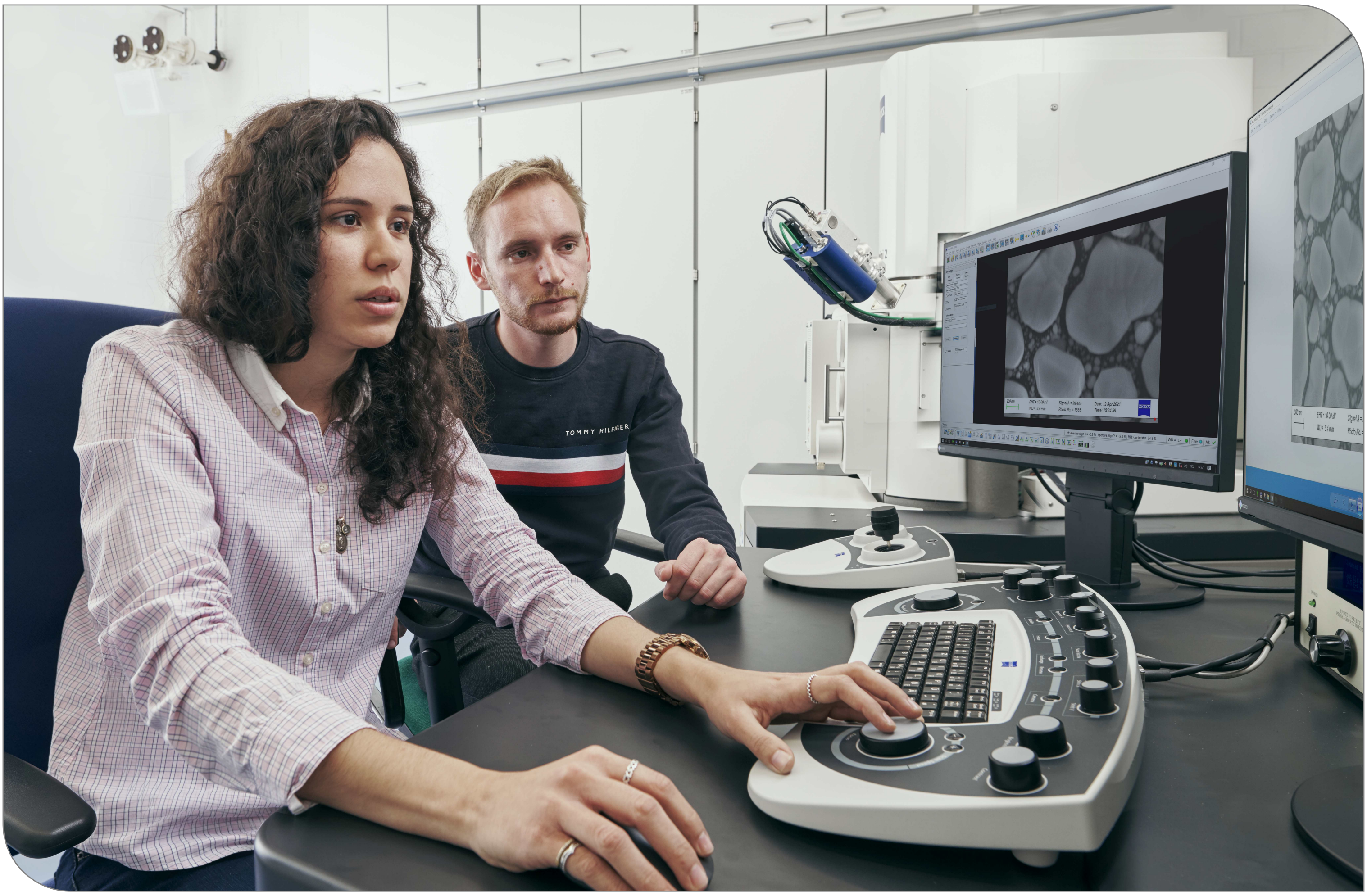
Module Handbook
Materials Science and Engineering Master 2025 (Master of Science (M.Sc.))

SPO 2025

Summer semester 2026

Date: 01/04/2026

KIT DEPARTMENT OF MECHANICAL ENGINEERING



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1 General Information

1.1 Study program details

KIT-Department	KIT Department of Mechanical Engineering
Academic Degree	Master of Science (M.Sc.)
Examination Regulations Version	2025
Regular semesters	4 semesters
Maximum semesters	7 semesters
Credits	120
Language	
Grade calculation	Weighted by (Weight * CP)
Additional Information	Link to study program www.mach.kit.edu/MatWerk.php

Qualification objectives

The graduates of the master’s program of Materials Science and Engineering of the KIT are able to participate independently in value-added processes from material development and production to further processing or product development and to contribute in science thanks to their research-based studies. They are mainly qualified for responsible jobs in industries, technical services and science and acquire the qualification for doctoral studies.

The graduates acquire a broad and deeper knowledge in the principles of natural and engineering science. A mandatory range that includes thermodynamics and kinetics, electronic and mechanical properties of materials, modelling and simulation as well as materials processing, ensures this. Thus, they are able to deal with the current state of research and to develop methods. They can develop, evaluate and interpret comprehensive and interdisciplinary simulation studies. They are able to develop, select and evaluate materials in value-added processes as well as suitable further processing techniques. To optimize their own approaches, the graduates have learned to overthink the methods they use and the actions they undertake and adapt them to varying boundary conditions.

In the area of specialization, consisting of two focal points, graduates acquire comprehensive and detailed knowledge in their chosen areas of materials science and engineering. In this context, the research-oriented competence is developed in specialized trainings in the KIT research laboratories within the scope of their selected specializations. Graduates are thus qualified to play an important role in complex research and development projects and to participate competently in the innovation process, and are professionally prepared for later leadership functions. In other elective subjects, including non-technical ones, students acquire further competences, particularly in social and economics subjects of their own choice. Amongst others, they are able to make well-considered decisions taking into account social, economic and ethical constraints. They have tested and consolidated their skills and knowledge in a company environment during an industrial training.

Graduates of the master’s program of Materials Science and Engineering of the KIT possess broad and deep knowledge. This solid basis enables them to grasp and assess even complex interrelationships with regard to the use and selection of materials in complex systems and to analyze them. In addition, they are able to understand the value chain from the material to its use in the system, taking into account technical, social, economic and ethical constraints. They can methodically develop, reflect on, evaluate and independently and sustainably design. They deal constructively with their own and others' views and represent their work results in a generally understandable form.

The graduates of the master’s program are qualified to identify tasks on their own, to collect information necessary to solve a problem, choose methods and apply skills regarding production, further processing, selection and deployment of materials, and thus contribute to value-added processes.

Studies Plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering (MatWerk) Studies and Examination Regulations Version of 2025 (PO-Version 2025)

The present English translation has no legally binding effect. It is provided for your information only.

Contents

History of Revisions (from 01.10.2020)

Date	Revision made
03.03.2026	Update of courses in the focal courses

0. List of Abbreviations

KIT Departments:	mach	KIT-Fakultät für Maschinenbau (KIT Department of Mechanical Engineering)
	inf	KIT-Fakultät für Informatik (KIT Department of Informatics)
	etit	KIT-Fakultät für Elektrotechnik und Informationstechnik (KIT Department of Electrical Engineering and Information Technology)
	chem	KIT-Fakultät für Chemie und Biowissenschaften (KIT Department of Chemistry and Biosciences)
	ciw	KIT-Fakultät für Chemieingenieurwesen und Verfahrenstechnik (KIT Department of Chemical and Process Engineering)
	phys	KIT-Fakultät für Physik (KIT Department of Physics)
	wiwi	KIT-Fakultät für Wirtschaftswissenschaften (KIT Department of Economics and Management)

Semester:	WS	Winter semester
	SS	Summer semester
	ww	optional (offered in both the summer and winter semesters)
Language:	D	Deutsch (German)
	E	Englisch (English)
Achievements:	V	Vorlesung (lecture)
	Ü	Übung (exercise)
	P	Praktikum (internship)
	LP	Leistungspunkte (credits)
	mPr	mündliche Prüfung (oral examination)
	sPr	schriftliche Prüfung (written examination)
	PA	Prüfungsleistung anderer Art (examination of another type)
	SL	Studienleistung (coursework)
	Gew	Gewichtung einer Prüfungsleistung im Modul bzw. in der Gesamtnote des Moduls (weighting of an examination result in the module or in the total grade of the module)

Others:	B.Sc.	Studiengang Bachelor of Science (Bachelor of Science program)
	M.Sc.	Studiengang Master of Science (Master of Science program)
	MatWerk	Materialwissenschaft und Werkstofftechnik (Materials Science and Engineering)
	SPO	Studien- und Prüfungsordnung (studies and examination regulations)
	SWS	Semesterwochenstunden (weekly teaching hours)
	w	wählbar (selectable)
	p	verpflichtend (mandatory)

1. Studies Plans, Modules, and Examinations

The credits (Leistungspunkte, LP) are given according to the “European Credit Transfer and Accumulation System“ (ECTS).

1.1. Examinations

Every semester, at least one examination date must be offered for every examination. Examinations dates and times as well as dates on which students have to register for the examinations at the latest are specified by the examination committee. As a rule, registration for the examination takes place at least one week before the examination. Registration and examination dates are announced on the notice board in due time. Dates of written examinations are announced at the beginning of the lecture period, if possible.

The examiner decides on aids that may be used during an examination. The list of permitted aids must be announced together with the examination date.

The following rules apply to controls of success in the focus modules: In principle, examinations have to be carried out orally. If the examination expenditure is unacceptably high, an oral examination may be replaced by a written one. Oral examinations in focus subjects or partial modules of focuses must have a duration of 5 minutes per credit. If an oral examination is assigned more than 12 credits, the examination duration shall be 60 minutes.

Required coursework can be repeated several times.

1.2. Modules in the Master’s Program

Studies within the master’s program may be started in the winter or in the summer semester. Due to the options available (focuses, interdisciplinary complementary courses, transferable skills), no generally valid studies plan can be given. The options regarding the focuses are listed below. When calculating the total module grade, graded controls of success are considered with the weights indicated (Gew).

In the mdoule “Überfachliche Qualifikationen” (Key Competencies), courses on key competences can be selected from the list of courses offered by the KIT House of Competence (HoC), KIT-Sprachenzentrum (SPZ, Language Center), and Studium Generale at the Forum Wissenschaft und Gesellschaft (FORUM, formerly ZAK) and controls of success in the total amount of 2 credits can be selected freely. At the student’s request, the examination committee can permit other, freely selectable controls of success in the module “Schlüsselqualifikationen” (key competences).

The following modules are part of the master's program:

Modules	Partial Achievement	Coordinator	Credits	Controls of Success	Gew
1 Thermodynamik und Kinetik (Thermodynamics and Kinetics)	Thermodynamische und Kinetische Grundlagen der Materialwissenschaft Thermodynamic and Kinetic Fundamentals of Material Science	Gorr	7	SL, mPr	7
2 Simulation (Simulation)	Angewandte Werkstoffsimulation Applied Materials Simulation	Gumbsch	6	SL, mPr	6
3 Eigenschaften (Properties)	Gefüge-Eigenschafts-Beziehungen Microstructure-Property Relationships	Kirchlechner	7	SL, mPr	7
4 Schwerpunktmodul(e) (Specialization module(s))	Cf. section 3		40	mPr	40
5 MINT Wahlmodul (MINT Elective Module)	Cf. module handbook		12	m/sPr	12
6 Technik und Gesellschaft (Technology and Society)	Cf. module handbook		4	optionally	4
7 Überfachliche Qualifikationen (Key Competencies)	HoC/SPZ/FORUM courses		2	SL*	0

In modules 1-3, all partial achievements are offered in both English and German.

In modules 4-7, students may choose from English or German partial achievements up to the total amount of credits of the module.

* The subject of "Überfachliche Qualifikationen" (Interdisciplinary Qualifications) and the module of "Schlüsselqualifikationen" (Key competences) are not graded. Graded controls of success in the Schlüsselqualifikationen (Key competences) are listed in the transcript of records, but not considered when calculating the total grade.

In addition, an internship of 9 weeks' duration has to be passed (12 credits).

After the module examinations, a master's thesis of 6 months' duration (30 credits) has to be written and presented.

1.3. Studies Plan of the Master's Program "M.Sc."

Plan of studies in German throughout:

<table>
<tr><td>Semester</td><td>WS
1</td><td>SS
2</td><td>WS
3</td><td>SS
4</td><td>Total</td></tr>
<tr><td>Subject</td><td>29 LP</td><td>33 LP</td><td>28 LP</td><td>30 LP</td><td>120 LP</td></tr>
<tr><td>Materialwiss. Vertiefung</td><td>Thermodynamik und Kinetik
7 LP, mPr</td><td>Simulation
6 LP, mPr
Eigenschaften
7 LP, mPr</td><td></td><td rowspan="6">Masterarbeit 30 LP</td><td>20 LP</td></tr>
<tr><td rowspan="3">Spezialisierung *</td><td colspan="2">Schwerpunkt
40 LP, 10 m/sPr</td><td rowspan="3"></td><td rowspan="3">40 LP</td></tr>
<tr><td colspan="2">Wahlmöglichkeit: 1 oder 2 Schwerpunkt(e)</td></tr>
<tr><td>Schwerpunkt I
20 LP, 5 m/sPr</td><td>Schwerpunkt II
20 LP, 5 m/sPr</td></tr>
<tr><td>Interdisziplinäre Ergänzung</td><td>Überfachliche Qualifikationen
2 LP, SL</td><td></td><td>MINT Wahlmodul
12 LP, 3 m/sPr
Technik und Gesellschaft
4 LP, SL</td><td>18 LP</td></tr>
<tr><td></td><td></td><td></td><td>Berufspraktikum
12 LP, SL</td><td>12 LP</td></tr>
</table>

* Selection of one or two out of three possible specialization modules according to Section 3. The precise amount of credits per semester depends on the courses chosen.

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering
SPO2025, Decision by the KIT Department Council of February 26, 2025 with editorial revisions, valid from 01.10.2025
5/13

Plan of studies in English throughout:

Semester	WS 1	SS 2	WS 3	SS 4	Total
Subject	29 credits	33 credits	28 credits	30 credits	120 credits
Materialwiss. Vertiefung (Materials Science Major Course)	Properties 7 credits, mPr	Simulation 6 credits, mPr Thermodynamics und Kinetics 7 credits, mPr		Master's thesis 30 LP	20 credits
Spezialisierung * (Specialization)	Specialization 40 credits, 10 m/sPr				40 credits
	Choice: 1 or 2 Specialization module(s)				
	Specialization I 20 credits, 5 m/sPr	Specialization II 20 credits, 5 m/sPr			
Interdisziplinäre Ergänzung (Interdisciplinary Complementation)	Key Competencies 2 credits, SL		MINT Elective Module 12 credits, 3 m/sPr Technology and Society 4 credits, SL		18 credits
			Internship 12 credits, SL		12 credits

* Selection of one or two out of three possible specialization modules according to Section 3. The precise amount of credits per semester depends on the courses chosen.

1.4. Master's Thesis Module

The master's thesis module consists of a master's thesis and a presentation of the background and scientific contents of the master's thesis. The presentation is to have a duration of 30 minutes, followed by a scientific discussion with the responsible supervisors and the public. The presentation and discussion will be considered when determining the total grade of the master's thesis module. Registration for the master's thesis has to take place via the Students Portal (Campus Management).

2. Internship

2.1. Contents and Organization of the Internship

Within the master's program, an internship must be passed according to SPO Article 14a. The internship is to provide insights into and experience in engineering work. The internship must have a minimum duration of 9 weeks. In any case, lost working time must be compensated. In case of lost working time, the intern should ask the company for an extension of the contract for him/her to be able to continue the internship as required.

The Internship Office (Praktikantenamt) does not find and offer internship places. The students themselves have to contact a company and ask for an internship place. The internship relationship becomes legally binding by the conclusion of a training contract (Ausbildungsvertrag) between the company and the intern. This contract defines all rights and obligations of the intern and the training company as well as the type and duration of the internship. In this connection, company is to be understood as a synonym of engineering offices, enterprises, authorities, etc. It is not permitted to pass an internship at an institution of KIT.

To ensure a sufficient scope of practical training, the intern must work in at least two different areas.

It may be chosen among the following areas:
- Werkstoffentwicklung (materials development)
- Werkstoffprüfung / Qualitätskontrolle (materials testing / quality control)
- Materialsynthese (materials synthesis)
- Werkstoffauswahl im Produktentstehungsprozess (materials selection in the product development process)
- Metallurgie / Pulvermetallurgie (metallurgy / powder metallurgy)
- Urformtechnik (molding)
- Umformtechnik (forming)
- Oberflächentechnik (surface treatment)
- Wärmebehandlung (thermal treatment)
- andere werkstofftechnische Tätigkeitsgebiete (nach Rücksprache mit dem Praktikantenamt der KIT-Fakultät für Maschinenbau) (other areas of materials engineering (upon agreement with the Internship Office of the KIT Department of Mechanical Engineering)).

2.2. Recognition of the Internship

For recognition of the internship, the original training contract and the original proof of activity have to be submitted. The types and durations of the individual activities must be clearly obvious from the documents. For recognition of the internship, an internship certificate (Praktikantenzeugnis) issued by the training company is required, which describes the types and durations of the activities during the internship. Days of absence have to be indicated. In addition, recognition of the internship requires the chairperson of the examination committee or an examiner according to Article 17, par. 2, SPO to confirm completion of the internship by a report and short presentation.

Students having acquired the university entrance qualification in Germany (Bildungsinländer) are strongly recommended to pass the complete or part of the internship abroad. Internships at foreign companies will only be recognized, however, if they comply with with the above regulations.

3. Specialization modules

3.1. Scope and Structure

In the master's program, one specialization module with 40 LP or two specialization modules with 20 LP each can be chosen from a list of specialization modules. The maximum amount of credits may be exceeded once only by registration of a partial achievement. It is not permitted to register additional partial achievements, if the maximum amount of credits has already been exceeded. Within a specialization module, at least 16 credits (of 20 credits) or 32 credits (of 40 credits) must be acquired by graded controls of success, respectively. The specialization module grade is calculated from the completed graded partial achievements.

In any case, all partial achievement grades are weighed according to their credits when determining the specialization module grade. When calculating the total grade, every specialization module is evaluated with its maximum amount of credits of 20 credits or 40 credits, respectively.

The combinations chosen from the selectable controls of success / partial achievements of the different focuses given below can be selected in CAMPUS. Deviating combinations may be permitted, but require the prior approval by the focus coordinators. Partial achievements from one specialization module should not be transferred to another specialization module.

3.2. Specialization modules (SP) and corresponding options

SP1: Konstruktionswerkstoffe (Structural Materials) Coordinator: Professor Heilmaier

Course number	Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2149671	Additive Fertigung metallischer Bauteile	Zanger	2	4	mPr	WS	D
2241020	Additive Manufacturing for Process Engineering	Klahn	2	5	mPr	SS	E
2126730	Advanced Ceramic Processing	Furlan	2	4	mPr	WS	E
2177601	Aufbau und Eigenschaften von Schutzschichten	Ulrich	2	4	mPr	WS	D
2181745	Auslegung hochbelasteter Bauteile	Aktaa	2	4	mPr	WS	D
2182100	Energieeffiziente und nachhaltige tribologische Systeme	Dienwiebel	2	4	mPr	SS	D
neu	Energy Efficient and Sustainable Tribological Systems	Dienwiebel	2	4	mPr	WS	E
2113102	Fahrzeugleichtbau – Strategien, Konzepte, Werkstoffe	Henning	2	4	sPr	WS	D
2182102	Failure Analysis	Bauer	2	4	mPr	SS	E
2114053	Faserverstärkte Kunststoffe - Polymere, Fasern, Halbzeuge, Verarbeitung	Henning	2	4	sPr	SS	D
2174575	Gießereikunde	Klan/Günther	2	4	sPr	SS	D
2193010	Grundlagen der Herstellungs-verfahren der Keramik und Pulvermetallurgie	Schell	2	4	mPr	WS	D
2193055	High Temperature Corrosion	Gorr	2	4	mPr	WS	E
2174605	High Temperature Materials	Heilmaier	2	4	mPr	WS	E
2173583	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement*	Pundt	2	4	mPr	SS	E
2186100	Jenseits konventioneller Werkstoffe - Metamaterialien und 3D strukturierte Bauteile	Bauer	2	4	mPr	WS	E
2182642	Laser Material Processing	Schneider	2	4	mPr	SS	E
2113111	Leichtbau-Workshop: Simulation und Fertigung	Kärger/ Liebig	2	4	mPr	WS	D
2174555	Non-ferrous Metals and Alloys	Heilmaier	3	4	mPr	SS	E
2173421	Phase Transformations in Materials	Heilmaier/ Kauffmann	2	4	mPr	WS	E
2173648	Plasticity of Metals and Intermetallics	Kauffmann	4	8	mPr	SS	E
2181750	Plastizität auf verschiedenen Skalen	Schulz/Greiner	2	4	PA	WS	D
2173590	Polymerengineering I	Liebig	2	4	mPr	WS	D
2174596	Polymerengineering II	Liebig	2	4	mPr	SS	D
2150704	Projektpraktikum Additive Fertigung: Designoptimierung und Herstellung metallischer Bauteile	Zanger	3	4	PA	SS	D
2126749	Pulvermetallurgische Hochleistungswerkstoffe	Schell	2	4	mPr	SS	D
2182572	Schadenskunde	Schneider/Greiner	2	4	mPr	WS	D
2173571	Schweißtechnik	Farajian	2	4	mPr	WS	D
2173586	Schwingfestigkeit	Guth	2	4	mPr	SS	D
2114107	Simulation der Prozesskette kontinuierlich verstärkter Faserverbundbauteile	Kärger	2	4	mPr	SS	D

2194729	Superhard Thin Film Materials**	Ulrich	2	4	mPr	SS	E
2177618	Superharte Dünnschichtmaterialien**	Ulrich	2	4	mPr	WS	D
2174579	Technologie der Stahlbauteile	Schulze	2	4	mPr	SS	D
2193051	Thermophysics of Advanced Materials	Sergeev	2	4	mPr	ww	E
neu	Thin Films – Structure, Thermodynamics, Applications in Energy Technologies	Wagner	2	4	mPr	SS	E
2150681	Umformtechnik	Herlan	2	4	mPr	SS	D
2174572	Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung*	Pundt	2	4	mPr	WS	D
2174574	Werkstoffe für den Leichtbau	Liebig	2	4	mPr	SS	D
2173600	Werkstoffe in der additiven Fertigung	Dietrich	2	4	mPr	WS	D
2173520	Werkstoffrecycling und Nachhaltigkeit	Liebig	2	4	mPr	SS	D
2174512	Zerstörungsfreie Materialprüfung	Dietrich	4	6	mPr	SS	D
2181708	Biomechanik: Design in der Natur und nach der Natur	Mattheck	2	4	SL	WS	D
2173560	Experimentelles schweißtechnisches Praktikum, in Gruppen	Schulze / Dietrich	3	4	SL	WS	D
2173584	Hydrogen in Materials: Exercises and Lab Course***	Wagner	2	4	SL	SS	E
2241021	Practical in Additive Manufacturing for Process Engineering	Klahn	1	1	SL	SS	E
2125751	Praktikum "Technische Keramik"	Schell	2	4	SL	WS	D
2182101	Praktikum zur Schadenskunde	Greiner	2	4	SL	SS	D
2174573	Wasserstoff in Materialien: Übungen und Laborkurs***	Wagner	2	4	SL	WS	D

* Only one of the two partial achievements “Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement“ and “Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung“ may be completed in the focal course SP1.

** Only one of the two partial achievements “Superharte Dünnschichtmaterialien“ and “Superhard Thin Film Materials” may be completed within the focal course SP1.

*** Only one of the two partial achievements “Hydrogen in Materials: Exercises and Lab Course “ and “Wasserstoff in Materialien: Übungen und Laborkurs “ may be completed in the focal course SP1.

SP2: Computational Materials Science Coordinator: Professor Nestler

Course number	Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2183717	Seminar Werkstoffsimulation / Seminar Materials Simulation (mandatory)	Gumbsch / Nestler / Böhlke	4	8	PA	WS/SS	D/E
2181745	Auslegung hochbelasteter Bauteile	Aktaa	2	4	mPr	WS	D
6215903 / 6215904	Bruch- und Schädigungsmechanik	Seelig	4	6	mPr	SS	D
4023161+ 4023162	Computational Condensed Matter Physics	Wenzel	6	12	mPr	SS	E
2161250+ 2161147	Computational Elasticicty	Böhlke / Langhoff	4	6	mPr	WS	E
2162296+ 2162297	Computational Inealsticity	Böhlke / Langhoff	4	6	mPr	SS	E
4023021+ 4023022	Computational Photonics	Rockstuhl	4	6	mPr	WS	E
2182741	Data Science and Scientific Workflows	Gumbsch / Weygand	3	4	SL, mPr	SS	D
2162282+ 2162257	Einführung in die Finite-Elemente-Methode	Böhlke / Langhoff	3	6	sPr	SS	D
2182732	Einführung in die Materialtheorie	Kamlah	2	4	mPr	SS	D
2305263+ 2305265	Electromagnetics and Numerical Calculation of Fields	Dössel	3	4	sPr	WS	E
2181720	Grundlagen der nichtlinearen Kontinuumsmechanik	Kamlah	2	4	mPr	WS	D
2182310	Grundlagen der Phasenfeldmodellierung	Schneider	3	4	mPr	WS	D
2183721	High Performance Computing	Nestler / Selzer	3	4	sPr	WS/SS	D
2162280 +2162281	Mathematische Methoden der Mikromechanik	Böhlke	3	6	sPr	SS	D
2142875	Mikrosystem Simulation	Korvink	3	4	sPr	SS	E
2162344	Nonlinear Continuum Mechanics	Böhlke	3	4	mPr	SS	E
2181740	Particle Dynamics and Atomistic Simulation	Gumbsch Weygand	3	4	mPr	SS	E
2183705	Phasenfeldmethode in der Thermodynamik	Prahs	3	4	mPr	WS	D
4023141+ 4023142	Simulation nanoskaliger Systeme	Wenzel	3	6	mPr	SS	D
4023151+ 4023152	The ABC of DFT	Wenzel	3	6	mPr	SS	E
2182740	Werkstoffmodellierung: Versetzungsbasierte Plastizität	Weygand	2	4	mPr	SS	D
2181738	Wissenschaftliches Programmieren für Ingenieure	Weygand / Gumbsch	2	4	mPr	WS	D

Passing of the partial achievement “Seminar Werkstoffsimulation" (can be taken in German or English) is mandatory in focal course SP2. The remaining credits may be chosen from the list of other controls of success / partial achievements.

SP3: Funktionswerkstoffe (Functional Materials) Coordinator: Professor Ehrenberg

Course number	Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2313724	Adaptive Optics	Gladysz	2	3	mPr	WS	E
2181550	Applied Surface Materials	Benayad	2	4	mPr	WS	E
5072	Batteries and Fuel Cells*	Ehrenberg / Scheiba	2	4	mPr	WS	E
2304240+ 2304241	Batteries, Fuel Cells, and Electrolysis*	Krewer	4	6	sPr	WS	E
2313770+ 2313771	Bauelemente der Opto- und Nanoelektronik	Lemmer	4	6	sPr	SS	D
4021011	Elektronische Eigenschaften von Festkörpern I	Weber / Weiß	4	8	mPr	WS	D
4021111	Elektronische Eigenschaften von Festkörpern II	Ustinov	2	4	mPr	SS	D
2193008	Engineering Materials for the Energy Transition**	Franke/Seifert	2	4	mPr	SS	E
2125740	Functional Ceramics***	Furlan	2	4	mPr	WS	E
2126784	Funktionskeramiken***	Botros	2	4	mPr	WS	D
2313734	Grundlagen der Plasmatechnologie	Kling	2	4	mPr	SS	D
5073	Hydrogen as Energy Carrier	Ehrenberg / Leon	2	4	mPr	WS	E
2309440+ 2309441	Integrated Photonics	Koos	4	6	mPr	WS	E
2141861	Introduction to Microsystem Technology I	Korvink	2	4	sPr	WS	E
2142874	Introduction to Microsystem Technology II	Korvink	2	4	sPr	SS	E
2301478	Laser Metrology	Eichhorn	2	3	mPr	SS	E
2193013	Lasergestützte Methoden und deren Einsatz für Energiespeichermaterialien	Pfleging	2	4	mPr	ww	D
2313747+ 2313749	Light and Display Engineering	Kling	3	4	mPr	WS	E
2245840	Materialien für elektrochemische Speicher und Wandler	Tübke	2	4	mPr	SS	D
2193007	Materialien und Werkstoffe für die Energiewende**	Seifert	2	4	mPr	WS	D
2178420	Mechanical Properties of Nanomaterials and Microsystems****	Gruber/ Kirchlechner/ Weygand	2	4	mPr	SS	E
2177013	Mechanische Eigenschaften von Nanomaterialien und Mikrosystemen****	Gruber/ Kirchlechner/ Weygand	2	4	mPr	WS	D
2141501	Mikro NMR Technologie	Korvink	2	4	PA	WS	E
5439	Moderne Charakterisierungs-methoden zur Charakterisierung von Materialien und Katalysatoren	Grunwaldt / Kleist / Lichtenberg	2	4	mPr	WS	D
4020021+ 4020022	Nano Optics	Naber	4	8	mPr	WS	E
2141865	Neue Aktoren und Sensoren	Kohl / Sommer	2	4	mPr	WS	D
2302150+ 2302151	Optical Engineering and Machine Vision	Heizmann	4	6	sPr	WS	E
2309460+ 2309461	Optical Transmitters and Receivers	Freude	4	6	mPr	WS	E
2309486+ 2309487	Optoelectronic Components	Freude	3	4	mPr	SS	E
2313768	Organic and Flexible Electronics	Hernandes Sosa	2	3	mPr	WS	E

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2025, Decision by the KIT Department Council of February 26, 2025 with editorial revisions, valid from 01.10.2025

12/13

2313737	Photovoltaik*****	Powalla	4	6	sPr	SS	D
2150550	Praktikum Produktionsintegrierte Messtechnik	Lanza	3	4	PA	SS	D
2143875	Praktikum zu Grundlagen der Mikrosystemtechnik	Last	2	3	sPr	ww	D
2304231	Sensoren	Menesklou	2	3	sPr	WS	D
2304240	Sensorsysteme	Wersing	2	3	mPr	SS	D
2312680+ 2312694	Single-Photon-Detectors	Ilin	3	4	mPr	WS	E
2313745+ 2313750	Solar Energy*****	Richards	4	6	sPr	WS	E
4020011	Solid State Optics	Hetterich	4	8	mPr	WS	E
2312698	Superconducting Magnet Technology	Arndt	3	4	mPr	SS	E
2312717	Superconducting Materials Lecture******	Holzapfel	2	3	mPr	WS	E
2312696	Superconducting Materials Lab******	Holzapfel	2	3	PA	SS	E
2314011	Superconducting Power Systems	Noe	3	4	mPr	WS	E
2312708 +2312709	Superconductivity for Engineers******	Holzapfel/ Kempf	3	5	sPr	WS/ SS	E
4023011+ 4023012	Theoretical Quantum Optics	Rockstuhl	3	6	mPr	WS	E
2312710+ 2312711	Physics, Technology and Applications of Thin Films	Ilin	2+1	4	mPr	WS	E
2312671	Superconducting Nanowire Detectors	Ilin	2+1	4	mPr	SS	E

* Only one of the two partial achievements “Batteries, Fuel Cells, and Electrolysis“ and “Batteries and Fuel Cells“ may be completed in the focal course SP4.

** Only one of the two partial achievements “Materialien und Werkstoffe für die Energiewende“ and Engineering Materials for the Energy Transition ““ may be completed in the focal course SP4.

*** Only one of the two partial achievements “Funktionskeramiken“ and “Functional Ceramics“may be completed in the focal course SP4.

**** Only one of the two partial achievements “Mechanische Eigenschaften von Nanomaterialien“ and “Mechanical Properties of Nanomaterials and Microsystems“may be completed in the focal course SP4.

***** Only one of the two partial achievements “Solar Energy“ and “Photovoltaik“ (photovoltaics) may be completed in the focal course SP4.

****** The partial achievements “Superconducting Materials Lecture” and “Superconducting Materials Lab” cannot be taken in combination with “Superconductivity for Engineers” in the focal course SP4.

4 Study Program Structure

Mandatory	
Master's Thesis	30 CP
Internship *This field will not influence the calculated grade of its parent.*	12 CP
Materials Science Major Course	20 CP
Interdisciplinary Complementation	18 CP
Specialization	40 CP
Voluntary	
Additional Examinations *This field will not influence the calculated grade of its parent.*	

4.1 Master's Thesis

Credits
30

Mandatory				
M-MACH-107332	Master's Thesis	DE	WS+SS	30 CP

4.2 Internship

Credits
12

Mandatory				
M-MACH-107331	Internship	DE	WS+SS	12 CP

4.3 Materials Science Major Course

Credits
20

Mandatory				
M-MACH-107324	Thermodynamics and Kinetics	DE/EN	WS+SS	7 CP
M-MACH-107325	Properties	DE/EN	WS+SS	7 CP
M-MACH-103712	Simulation	DE/EN	SS	6 CP

4.4 Interdisciplinary Complementation

Credits
18

Mandatory				
M-MACH-107326	MINT Elective Module	DE/EN	WS+SS	12 CP
M-MACH-106939	Technology and Society	DE/EN	WS+SS	4 CP
M-MACH-107330	Key Competencies	DE	WS+SS	2 CP

4.5 Specialization

Credits
40

Election notes
In the “Specialization” subject, one specialization module with 40 LP or two specialization modules with 20 LP can be chosen from a list of specialization modules.

Specialization (Election: 40 credits)				
M-MACH-107559	Computational Materials Science (20CP)	DE	WS+SS	20 CP
M-MACH-107561	Functional Materials (20CP)	DE	WS+SS	20 CP
M-MACH-107562	Structural Materials (20CP)	DE	WS+SS	20 CP
M-MACH-107575	Computational Materials Science (40CP)	DE	WS+SS	40 CP
M-MACH-107576	Functional Materials (40CP)	DE	WS+SS	40 CP
M-MACH-107577	Structural Materials (40CP)	DE	WS+SS	40 CP

4.6 Additional Examinations

Additional Examinations (Election: at most 30 credits)				
M-FORUM-106753	Supplementary Studies on Science, Technology and Society	DE	WS+SS	16 CP

5 Modules

M 5.1 Module: Computational Materials Science (20CP) [M-MACH-107559]

Coordinators: Prof. Dr. Britta Nestler
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
20 CP	graded	Each term	2 terms	German	4	2

Compulsory Course (Election: 1 item)			
T-MACH-107660	Seminar "Materials Modelling"	8 CP	Nestler, Schulz
T-MACH-113814	Seminar Materials Simulation	8 CP	Nestler, Schulz
Compulsary Elective Studies (Election: at least 12 credits)			
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-BGU-100087	Fracture and Damage Mechanics	6 CP	Seelig
T-PHYS-109895	Computational Condensed Matter Physics	12 CP	Wenzel
T-MACH-113989	Computational Elasticity	5 CP	Böhlke, Langhoff
T-MACH-113990	Computational Inelasticity	5 CP	Böhlke, Langhoff
T-PHYS-106131	Computational Photonics, without ext. Exercises	6 CP	Rockstuhl
T-MACH-111588	Data Science and Scientific Workflows	3 CP	Gumbsch, Weygand
T-MACH-111603	Data Science and Scientific Workflows (Project)	1 CP	Gumbsch, Weygand
T-MACH-105320	Introduction to the Finite Element Method	3 CP	Böhlke, Langhoff
T-MACH-105321	Introduction to Theory of Materials	4 CP	Kamlah
T-ETIT-100640	Electromagnetics and Numerical Calculation of Fields	4 CP	Deng, Lemmer
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CP	Kamlah
T-MACH-114627	Fundamentals of Phase-Field Modelling	4 CP	Schneider
T-MACH-105398	High Performance Computing	4 CP	Nestler, Reder, Selzer, Weichel
T-MACH-110378	Mathematical Methods in Micromechanics	5 CP	Böhlke
T-MACH-108383	Microsystem Simulation	4 CP	Korvink
T-MACH-111026	Nonlinear Continuum Mechanics	6 CP	Böhlke
T-MACH-114129	Particle Dynamics and Atomistic Simulation	4 CP	Gumbsch, Schneider, Weygand
T-MACH-113694	Phase-Field Method in Thermomechanics	4 CP	Prahs
T-PHYS-102504	Simulation of Nanoscale Systems, without Seminar	6 CP	Wenzel
T-PHYS-105960	The ABC of DFT	6 CP	Rockstuhl, Wenzel
T-MACH-114529	Tutorial Computational Elasticity	1 CP	Böhlke, Langhoff
T-MACH-114530	Tutorial Computational Inelasticity	1 CP	Böhlke, Langhoff
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	2 CP	Böhlke
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CP	Böhlke, Langhoff
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CP	Böhlke
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CP	Weygand
T-MACH-100532	Scientific Computing for Engineers	4 CP	Gumbsch, Weygand

Assessment
The success controls usually include an “Alternative academic assessment” in the form of a seminar paper including a presentation (Compulsory Course “Seminar Materials Modelling") as well as three oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses

Prerequisites
None

Competence Goal
After attending the emphasis "Computational Materials Science" the students will gain the following skills

- They can independently elaborate a scientific problem in the field of "Computational Materials Science".
- They can choose suitable methods as well as techniques and use or refine them to solve his problem.

The individual learning outcomes depend very much on the lectures chosen within the emphasis "Computational Materials Science" and therefore are explicitly described there.

Content
Within the emphasis "Computational Materials Science" are presented the basics of different modeling and simulation methods, which can be used to elaborate problems from the field of "Computational Materials Science" at different length scales.

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

Workload
The usual work load is:

presence time: 110 h

preparation and rework time: 490 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.2 Module: Computational Materials Science (40CP) [M-MACH-107575]

Coordinators: Prof. Dr. Britta Nestler
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
40 CP	graded	Each term	2 terms	German	4	2

Compulsory Course (Election: 1 item)			
T-MACH-107660	Seminar "Materials Modelling"	8 CP	Nestler, Schulz
T-MACH-113814	Seminar Materials Simulation	8 CP	Nestler, Schulz
Compulsary Elective Studies (Election: at least 32 credits)			
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-BGU-100087	Fracture and Damage Mechanics	6 CP	Seelig
T-PHYS-109895	Computational Condensed Matter Physics	12 CP	Wenzel
T-MACH-113989	Computational Elasticity	5 CP	Böhlke, Langhoff
T-MACH-113990	Computational Inelasticity	5 CP	Böhlke, Langhoff
T-PHYS-106131	Computational Photonics, without ext. Exercises	6 CP	Rockstuhl
T-MACH-111588	Data Science and Scientific Workflows	3 CP	Gumbsch, Weygand
T-MACH-111603	Data Science and Scientific Workflows (Project)	1 CP	Gumbsch, Weygand
T-MACH-105320	Introduction to the Finite Element Method	3 CP	Böhlke, Langhoff
T-MACH-105321	Introduction to Theory of Materials	4 CP	Kamlah
T-ETIT-100640	Electromagnetics and Numerical Calculation of Fields	4 CP	Deng, Lemmer
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CP	Kamlah
T-MACH-114627	Fundamentals of Phase-Field Modelling	4 CP	Schneider
T-MACH-105398	High Performance Computing	4 CP	Nestler, Reder, Selzer, Weichel
T-MACH-110378	Mathematical Methods in Micromechanics	5 CP	Böhlke
T-MACH-108383	Microsystem Simulation	4 CP	Korvink
T-MACH-111026	Nonlinear Continuum Mechanics	6 CP	Böhlke
T-MACH-114129	Particle Dynamics and Atomistic Simulation	4 CP	Gumbsch, Schneider, Weygand
T-MACH-113694	Phase-Field Method in Thermomechanics	4 CP	Prahs
T-PHYS-102504	Simulation of Nanoscale Systems, without Seminar	6 CP	Wenzel
T-PHYS-105960	The ABC of DFT	6 CP	Rockstuhl, Wenzel
T-MACH-114529	Tutorial Computational Elasticity	1 CP	Böhlke, Langhoff
T-MACH-114530	Tutorial Computational Inelasticity	1 CP	Böhlke, Langhoff
T-MACH-111027	Tutorial Nonlinear Continuum Mechanics	2 CP	Böhlke
T-MACH-110330	Tutorial Introduction to the Finite Element Method	1 CP	Böhlke, Langhoff
T-MACH-110379	Tutorial Mathematical Methods in Micromechanics	1 CP	Böhlke
T-MACH-105369	Materials Modelling: Dislocation Based Plasticity	4 CP	Weygand
T-MACH-100532	Scientific Computing for Engineers	4 CP	Gumbsch, Weygand

Assessment
The success controls usually include an “Alternative academic assessment” in the form of a seminar paper including a presentation (Compulsory Course “Seminar Materials Modelling") as well as eight oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses

Prerequisites
None

Competence Goal
After attending the emphasis "Computational Materials Science" the students will gain the following skills

- They can independently elaborate a scientific problem in the field of "Computational Materials Science".
- They can choose suitable methods as well as techniques and use or refine them to solve his problem.

The individual learning outcomes depend very much on the lectures chosen within the emphasis "Computational Materials Science" and therefore are explicitly described there.

Content
Within the emphasis "Computational Materials Science" are presented the basics of different modeling and simulation methods, which can be used to elaborate problems from the field of "Computational Materials Science" at different length scales.

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

Workload
The usual work load is:

presence time: 220 h

preparation and rework time: 980 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.3 Module: Functional Materials (20CP) [M-MACH-107561]

Coordinators: Prof. Dr. Helmut Ehrenberg
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
20 CP	graded	Each term	2 terms	German	4	2

Compulsary Elective Studies (Election: at least 20 credits)			
T-ETIT-107644	Adaptive Optics	3 CP	Gladysz, Lemmer
T-MACH-114646	Applied Surface Materials	4 CP	Benayad
T-CHEMBIO-112316	Batteries and Fuel Cells	4 CP	Ehrenberg
T-ETIT-113986	Batteries, Fuel Cells, and Electrolysis	5 CP	Krewer
T-ETIT-114957	Batteries, Fuel Cells, and Electrolysis - Group Project	1 CP	Krewer
T-ETIT-114165	Opto- and Nanoelectronic Devices	6 CP	Lemmer
T-PHYS-102578	Electronic Properties of Solids I, without Exercises	8 CP	Le Tacon, Wernsdorfer, Wulfhekel
T-PHYS-104423	Electronic Properties of Solids II, without Exercises	4 CP	Le Tacon, Rotzinger, Ustinov, Wernsdorfer
T-MACH-112691	Engineering Materials for the Energy Transition	4 CP	Seifert
T-MACH-114752	Functional Ceramics	4 CP	Pagnan Furlan
T-MACH-105179	Functional Ceramics	4 CP	Botros
T-ETIT-100770	Fundamentals on Plasma Technology	3 CP	Kling
T-CHEMBIO-112317	Hydrogen as Energy Carrier	4 CP	Ehrenberg
T-ETIT-114418	Integrated Photonics	6 CP	Koos
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-ETIT-100643	Laser Metrology	3 CP	Eichhorn
T-MACH-106739	Laser-Assisted Methods and Their Application for Energy Storage Materials	4 CP	Pfleging
T-ETIT-100644	Light and Display Engineering	4 CP	Kling
T-CIWVT-108146	Materials and Processes for Electrochemical Storage	4 CP	Tübke
T-MACH-109082	Engineering Materials for the Energy Transition	4 CP	Seifert
T-MACH-114018	Mechanical Properties of Nanomaterials and Microsystems	4 CP	Gruber, Kirchlechner, Weygand
T-MACH-114071	Mechanical Properties of Nanomaterials and Microsystems (in German)	4 CP	Gruber, Kirchlechner, Weygand
T-MACH-105782	Micro Magnetic Resonannce	4 CP	Korvink, MacKinnon
T-CHEMBIO-107822	Modern Characterization Methods for Materials and Catalysts	4 CP	
T-PHYS-102282	Nano-Optics	8 CP	Naber
T-MACH-102152	Novel Actuators and Sensors	4 CP	Kohl, Sommer
T-ETIT-113941	Optical Engineering and Machine Vision	6 CP	Heizmann
T-ETIT-100639	Optical Transmitters and Receivers	6 CP	Freude
T-ETIT-101907	Optoelectronic Components	4 CP	Huber-Loyola
T-ETIT-114638	Organic and Flexible Electronics	4 CP	Hernandez Sosa
T-ETIT-101939	Photovoltaics	6 CP	Powalla
T-ETIT-111237	Physics, Technology and Applications of Thin Films	4 CP	Ilin
T-MACH-108878	Laboratory Production Metrology	4 CP	Benfer, Lanza
T-MACH-102164	Practical Training in Basics of Microsystem Technology	3 CP	Last
T-ETIT-101911	Sensors	3 CP	Schröder

T-ETIT-100709	Sensor Systems	3 CP	Menesklou
T-ETIT-108390	Single-Photon Detectors	4 CP	Ilin
T-ETIT-100774	Solar Energy	6 CP	Paetzold, Richards
T-PHYS-104773	Solid-State Optics, without Exercises	8 CP	Hetterich
T-ETIT-113440	Superconducting Magnet Technology	4 CP	Arndt
T-ETIT-114730	Superconducting Materials Lab	3 CP	Hänisch, Holzapfel
T-ETIT-114729	Superconducting Materials Lecture	3 CP	Hänisch, Holzapfel
T-ETIT-111236	Superconducting Nanowire Detectors	4 CP	Ilin
T-ETIT-113439	Superconducting Power Systems	4 CP	Noe
T-ETIT-111239	Superconductivity for Engineers	6 CP	Holzapfel
T-PHYS-110303	Theoretical Quantum Optics	6 CP	Metelmann, Rockstuhl

Assessment
The success controls usually include five oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses.

Competence Goal
Students aquire special basic knowledge in selected areas of materials science and engineering and can apply them to technical problems. The specific teaching objectives are agreed with the respective coordinator of the course.

Content
see respective courses

Workload
The usual work load is:

presence time: 110 h

preparation and rework time: 490 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.4 Module: Functional Materials (40CP) [M-MACH-107576]

Coordinators: Prof. Dr. Helmut Ehrenberg
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
40 CP	graded	Each term	2 terms	German	4	2

Compulsary Elective Studies (Election: at least 40 credits)			
T-ETIT-107644	Adaptive Optics	3 CP	Gladysz, Lemmer
T-MACH-114646	Applied Surface Materials	4 CP	Benayad
T-CHEMBIO-112316	Batteries and Fuel Cells	4 CP	Ehrenberg
T-ETIT-113986	Batteries, Fuel Cells, and Electrolysis	5 CP	Krewer
T-ETIT-114957	Batteries, Fuel Cells, and Electrolysis - Group Project	1 CP	Krewer
T-ETIT-114165	Opto- and Nanoelectronic Devices	6 CP	Lemmer
T-PHYS-102578	Electronic Properties of Solids I, without Exercises	8 CP	Le Tacon, Wernsdorfer, Wulfhekel
T-PHYS-104423	Electronic Properties of Solids II, without Exercises	4 CP	Le Tacon, Rotzinger, Ustinov, Wernsdorfer
T-MACH-112691	Engineering Materials for the Energy Transition	4 CP	Seifert
T-MACH-114752	Functional Ceramics	4 CP	Pagnan Furlan
T-MACH-105179	Functional Ceramics	4 CP	Botros
T-ETIT-100770	Fundamentals on Plasma Technology	3 CP	Kling
T-CHEMBIO-112317	Hydrogen as Energy Carrier	4 CP	Ehrenberg
T-ETIT-114418	Integrated Photonics	6 CP	Koos
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-ETIT-100643	Laser Metrology	3 CP	Eichhorn
T-MACH-106739	Laser-Assisted Methods and Their Application for Energy Storage Materials	4 CP	Pfleging
T-ETIT-100644	Light and Display Engineering	4 CP	Kling
T-CIWVT-108146	Materials and Processes for Electrochemical Storage	4 CP	Tübke
T-MACH-109082	Engineering Materials for the Energy Transition	4 CP	Seifert
T-MACH-114018	Mechanical Properties of Nanomaterials and Microsystems	4 CP	Gruber, Kirchlechner, Weygand
T-MACH-114071	Mechanical Properties of Nanomaterials and Microsystems (in German)	4 CP	Gruber, Kirchlechner, Weygand
T-MACH-105782	Micro Magnetic Resonannce	4 CP	Korvink, MacKinnon
T-CHEMBIO-107822	Modern Characterization Methods for Materials and Catalysts	4 CP	
T-PHYS-102282	Nano-Optics	8 CP	Naber
T-MACH-102152	Novel Actuators and Sensors	4 CP	Kohl, Sommer
T-ETIT-113941	Optical Engineering and Machine Vision	6 CP	Heizmann
T-ETIT-100639	Optical Transmitters and Receivers	6 CP	Freude
T-ETIT-101907	Optoelectronic Components	4 CP	Huber-Loyola
T-ETIT-114638	Organic and Flexible Electronics	4 CP	Hernandez Sosa
T-ETIT-101939	Photovoltaics	6 CP	Powalla
T-ETIT-111237	Physics, Technology and Applications of Thin Films	4 CP	Ilin
T-MACH-108878	Laboratory Production Metrology	4 CP	Benfer, Lanza
T-MACH-102164	Practical Training in Basics of Microsystem Technology	3 CP	Last
T-ETIT-101911	Sensors	3 CP	Schröder

T-ETIT-100709	Sensor Systems	3 CP	Menesklou
T-ETIT-108390	Single-Photon Detectors	4 CP	Ilin
T-ETIT-100774	Solar Energy	6 CP	Paetzold, Richards
T-PHYS-104773	Solid-State Optics, without Exercises	8 CP	Hetterich
T-ETIT-113440	Superconducting Magnet Technology	4 CP	Arndt
T-ETIT-114730	Superconducting Materials Lab	3 CP	Hänisch, Holzapfel
T-ETIT-114729	Superconducting Materials Lecture	3 CP	Hänisch, Holzapfel
T-ETIT-111236	Superconducting Nanowire Detectors	4 CP	Ilin
T-ETIT-113439	Superconducting Power Systems	4 CP	Noe
T-ETIT-111239	Superconductivity for Engineers	6 CP	Holzapfel
T-PHYS-110303	Theoretical Quantum Optics	6 CP	Metelmann, Rockstuhl

Assessment
The success controls usually include ten oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses.

Competence Goal
Students aquire special basic knowledge in selected areas of materials science and engineering and can apply them to technical problems. The specific teaching objectives are agreed with the respective coordinator of the course.

Content
see respective courses

Workload
The usual work load is:

presence time: 220 h

preparation and rework time: 980 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.5 Module: Internship [M-MACH-107331]

Coordinators: Dr. Patric Gruber
Organisation: KIT Department of Mechanical Engineering
Part of: Internship

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

Mandatory			
T-MACH-114409	Internship	12 CP	Gruber

Assessment
Presentation of the internship documents (training contract, activity report, internship certificate) as well as placement of an internship report in the form of a short oral presentation (about 10 min) and a written report (2-3 pages respectively 6-8 sheets, text included).

Prerequisites
None

Competence Goal
The students gain a first insight into industrial practice. They can apply their previously learned skills to problems in practice. The students get to know different fields of activity of a company. Thus, they are able to assess the requirements of different tasks and can use this knowledge for their future career choices.

Content
In order to ensure an adequate breadth of work experience, activities from at least two different areas of materials science must be proven.

The activities may be composed of the following areas:

- Materials development
- Materials testing / quality assessment
- Materials synthesis
- Materials selection in product design and processing
- Metallurgy / Powder metallurgy
- Primary shaping technology
- Forming technology
- Surface technology
- Heat treatment
- alternative working area in materials engineering (after consulting the examination board)

Additional Information
As part of the master's program, an internship must be completed in accordance with SPO. The compulsory minimum duration is 9 weeks full time. Missed working hours must be made up in any case. In the case of time off, the trainee should ask the training company for a contract extension in order to be able to get the work experience to the required extent.

The internship office does not convey internships. The students have to contact a company and ask for a suitable internship. The internship relationship becomes legally binding through the training contract to be concluded between the company and the trainee. The contract defines all rights and obligations of the trainee and the training company as well as the type and duration of the work experience. The term “company” is synonymous here with engineering firms, enterprises, authorities etc. However, the internship cannot be completed at a KIT facility.

Workload
Presence time in the company including preparation of internship report: 9 weeks x 40 h/week = 360 h

Teaching and Learning Methods
Professional practical training

M 5.6 Module: Key Competencies [M-MACH-107330]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: Interdisciplinary Complementation

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

Election Notes
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC), at the Forum Wissenschaft und Gesellschaft (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".

Key Competencies (Election:)			
T-MACH-112686	Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded	1 CP	Pundt
T-MACH-112687	Self-Booking-MSc-HOC-SPZ-FORUM-Graded	1 CP	Pundt
T-MACH-113321	Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded	1 CP	Pundt
T-MACH-113322	Self-Booking-MSc-HOC-SPZ-FORUM-Graded	1 CP	Pundt

Prerequisites
None

Competence Goal
After completing the module "Key Competences", students can:

- define and coordinate work steps, projects and goals, proceed systematically and purposefully, set priorities, identify insignificance and assess the feasibility of a task,
- apply the principles of safeguarding good scientific practice,
- describe and apply methods for planning a specific task under given conditions in a goal-oriented and resource-oriented manner,
- describe methods for scientific research and selection of subject information according to pre-established quality criteria and apply them to given problems,
- professionally evaluate the quality of a reference,
- discuss empirical methods and apply them to selected examples,
- present technical information in a clear, legible and convincingly argued manner in various forms (e.g. poster, exposé, abstract) in writing and visualize it graphically (e.g. design drawings, flowcharts),
- present and defend technical content in a convincing and appealing way
- work in a heterogeneous team in a task-oriented manner, manage and solve conflicts on their own and take responsibility for themselves and others,
- communicate constructively in a team in a goal-oriented and interpersonal manner, represent one's own interests, reflect and take into account the interests of others in their own words, and successfully form the course of the conversation.

Content
The module "Key Competences" form freely selectable courses from the offer of the KIT-House of Competence (HoC), the KIT Language Center (SPZ) and the Studium Generale at the Forum Wissenschaft und Gesellschaft (FORUM, formerly ZAK) with a total of at least 4 credits. Upon request, the Examination Board may approve further courses as elective subjects in the module "Key Competences".

Workload
The work load results from the sum of work loads of the chosen courses.

M 5.7 Module: Master's Thesis [M-MACH-107332]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: Master's Thesis

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	graded	Each term	1 term	German	4	1

Mandatory			
T-MACH-114410	Master's Thesis	30 CP	Pundt

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

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

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

The master thesis is to be evaluated by not less than a professor from KIT or habilitated member of the KIT Department of Mechanical Engineering and another examiner. Generally, one of the two examiners is the person who has assigned the thesis.

If the examiners do not agree, the master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master thesis has to be graded within a period of eight weeks after the submission.

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

Prerequisites
The requirement for admission to the master thesis module are 74 ECTS. As to exceptions, the examination board decides on a request of the student.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 74 credits in your study program.

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

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

Content
The student shall be allowed to make suggestions for the topic of his/her master thesis. The topic is set by the supervisor of the thesis in accordance with the effective SPO.

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

5.8 Module: MINT Elective Module [M-MACH-107326]

Coordinators: Dr. Patric Gruber
Organisation: KIT Department of Mechanical Engineering
Part of: Interdisciplinary Complementation

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each term	2 terms	German/English	4	2

Election Notes
One or more partial performances with at least 12 LP in total must be successfully completed.

Compulsory Elective Subjects (Election: at least 12 credits)			
T-CHEMBIO-100302	Applied Chemistry	4 CP	Deutschmann, Grunwaldt, Meier, Théato
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CP	Albers, Lorentz, Matthiesen
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CP	Düser, Ott
T-INFO-101363	Automated Visual Inspection and Image Processing	6 CP	Beyerer
T-MACH-102203	Automotive Engineering I	8 CP	Gauterin, Gießler
T-MACH-106424	Rail System Technology	4 CP	Cichon
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-105212	CAE-Workshop	4 CP	Düser
T-BGU-115007	Chemistry of Interfaces	6 CP	Bogner, Thissen
T-ETIT-101938	Communication Systems and Protocols	5 CP	Becker, Becker
T-MACH-105694	Data Analytics for Engineers	5 CP	Meisenbacher, Mikut, Reischl
T-MACH-113405	Drive System Engineering A: Automotive Systems	4 CP	Ott
T-MACH-111807	Introduction to Bionics	4 CP	Hölscher
T-PHYS-111915	Electron Microscopy I and II, with Exercises	16 CP	Eggeler
T-MACH-105151	Energy Efficient Intralogistic Systems	4 CP	Kramer, Schönung
T-ETIT-103613	Fabrication and Characterisation of Optoelectronic Devices	3 CP	Paetzold
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CP	Bade
T-PHYS-103628	Fundamentals of Optics and Photonics	8 CP	Hunger, Kreysing, Lemmer
T-PHYS-103630	Fundamentals of Optics and Photonics - Unit	0 CP	Hunger, Kreysing, Lemmer
T-INFO-101262	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	3 CP	Asfour, Spetzger
T-CIWVT-111063	Genetics	2 CP	Neumann
T-MACH-100092	Automotive Engineering I (in German)	8 CP	Gießler
T-MACH-105213	Fundamentals of Combustion I (in German)	4 CP	Fischlschweiger
T-MACH-114043	Fundamentals of Combustion I	4 CP	Fischlschweiger
T-MACH-105325	Fundamentals of Combustion II (in German)	4 CP	Bykov, Fischlschweiger
T-MACH-114044	Fundamentals of Combustion II	4 CP	Bykov, Fischlschweiger
T-CIWVT-106104	Combustion Technology	6 CP	Trimis

T-MACH-111389	Fundamentals in the Development of Commercial Vehicles	4 CP	Weber
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-ETIT-100784	Hybrid and Electric Vehicles	4 CP	Doppelbauer
T-INFO-115014	Localization of Mobile Agents	6 CP	Hanebeck
T-INFO-115015	Localization of Mobile Agents - Pass	0 CP	Hanebeck
T-MACH-103622	Measurement and Control Systems	6 CP	Stiller
T-ETIT-113625	Medical Imaging Technology	6 CP	Spadea
T-ETIT-113607	Medical Measurement Technology	6 CP	Nahm
T-CIWVT-108837	Measurement Techniques in the Thermo-Fluid Dynamics	6 CP	Trimis
T-INFO-102061	Mobile Computing and Internet of Things	3 CP	Beigl
T-INFO-113119	Mobile Computing and Internet of Things - Exercise	2 CP	Beigl
T-ETIT-113630	Modeling Physiological Systems	6 CP	Loewe
T-ETIT-114690	Modeling Physiological Systems - Workshop	0 CP	Loewe
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-ETIT-111815	Physiology and Anatomy for Biomedical Engineering	6 CP	Nahm
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-ETIT-100711	Practical Aspects of Electrical Drives	4 CP	Doppelbauer
T-MACH-105147	Product Lifecycle Management	4 CP	Ovtcharova
T-MACH-110318	Product- and Production-Concepts for Modern Automobiles	4 CP	Kienzle, Steegmüller
T-MACH-102107	Quality Management	4 CP	Lanza
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-MACH-105353	Rail Vehicle Technology	4 CP	Cichon
T-ETIT-101911	Sensors	3 CP	Schröder
T-ETIT-113837	Signal Processing Methods	6 CP	Wahls
T-MACH-106493	Solar Thermal Energy Systems	4 CP	Dagan
T-MACH-102170	Structural and Phase Analysis	4 CP	Wagner
T-MACH-105363	Thermal Turbomachines I	6 CP	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CP	Bauer
T-MACH-114853	Tribology	6 CP	Dienwiebel, Scherge
T-MACH-114854	Exercices - Tribology	2 CP	Dienwiebel
T-MACH-102194	Combustion Engines I	4 CP	Koch, Kubach
T-MACH-104609	Combustion Engines II	5 CP	Koch, Kubach
T-CIWVT-111062	Cell Biology	3 CP	Gottwald

Assessment
The success control includes three oral exams of about 25 minutes each as standard. However, amount, type and scope of the success control can vary according to the individually choice.

Prerequisites
None

Competence Goal
After completing the module, students will have expanded their knowledge in other engineering sciences such as electrical engineering or mechanical engineering, in the natural sciences, or in computer science. They will have learned about the approaches used in these fields based on a topic that differs sufficiently from the topics covered in materials science and engineering, and will therefore be familiar with the specific methodology of one of these subject areas and have mastered its fundamentals. This will enable them to apply this knowledge to interdisciplinary problems and to independently acquire new subject-specific knowledge later on. The specific learning objectives can be found in the selected course descriptions.

Content
see title and content of the given courses.

Workload
The workload amounts to approximately 360 hours, corresponding to 12 credit points.

However, the composition of the workload varies depending on the individual choice of partial performances.

Teaching and Learning Methods
Lectures, exercises (depending on the course)

5.9 Module: Properties [M-MACH-107325]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Organisation: KIT Department of Mechanical Engineering
Part of: Materials Science Major Course

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each term	1 term	German/English	4	1

Election Notes
The module can be passed either in English or in German. The selection is set by the combined allocation of the corresponding courses in English or in German including all associated assessments. The courses in English and in German are mutually exclusive. The preparatory courses (“exercises“) are a prerequisite for the superordinate course in the same teaching language.

Compulsory Elective Subjects (Election: 2 items as well as 7 credits)			
T-MACH-114407	Exercises for Microstructure-Property-Relationships (in German)	2 CP	Gruber, Kirchlechner
T-MACH-114398	Microstructure-Property-Relationships (in German)	5 CP	Gruber, Kirchlechner
T-MACH-114408	Exercises for Microstructure-Property-Relationships	2 CP	Gruber, Kirchlechner
T-MACH-114399	Microstructure-Property-Relationships	5 CP	Gruber, Kirchlechner

Assessment
The assessment consists of a certificate and an oral exam (about 30 minutes).

Prerequisites
None

Competence Goal
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

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.

Workload
The workload for the module “Properties” is 210 h per semester and consists of the presence during the lectures (33 h) and tutorials (12 h) as well as self-study for the lecture (117 h) and for the tutorials (48 h).

Teaching and Learning Methods
Lectures (Obligatory)
Tutorials (Obligatory)

5.10 Module: Simulation [M-MACH-103712]

Coordinators: Prof. Dr. Peter Gumbsch
Organisation: KIT Department of Mechanical Engineering
Part of: Materials Science Major Course

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German/English	4	3

Election Notes
The module can be passed either in English or in German. The selection is set by the combined allocation of the corresponding courses in English or in German including all associated assessments. The courses in English and in German are mutually exclusive. The preparatory courses (“exercises“) are a prerequisite for the superordinate course in the same teaching language.

Compulsory Elective Subjects (Election: 2 items as well as 6 credits)			
T-MACH-107671	Exercises for Applied Materials Simulation	2 CP	Gumbsch, Schneider, Weygand
T-MACH-105527	Applied Materials Simulation	4 CP	Gumbsch, Schneider, Weygand
T-MACH-110928	Exercises for Applied Materials Simulation	2 CP	Gumbsch, Schneider, Weygand
T-MACH-110929	Applied Materials Simulation	4 CP	Gumbsch, Schneider, Weygand

Assessment
The assessment consists of a certificate and an oral exam (about 30 minutes).

Prerequisites
None

Competence Goal
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
- name and discuss the possibilities and challenges of simulation approaches on different scales

Content
The modul introduces a general overview of different numerical methods and their range of application in materials science and engineering. A basic introduction to numerial methods is given and their application in different fields and scales is shown and discussed. Based on theoretical as well as practical aspects, the opportunities and challenges of numerical materials simulation is evaluated.

Workload
The workload for the modul “Simulation” is 180 h per semester and consists of the presence during the lectures (33 h) and tutorials (12 h) as well as self-study for the lecture (87 h) and for the tutorials (48 h).

Teaching and Learning Methods
lecture, exercise

5.11 Module: Structural Materials (20CP) [M-MACH-107562]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
20 CP	graded	Each term	2 terms	German	4	2

Compulsory Elective Subjects Examinations (Election: at least 16 credits)			
T-MACH-113985	Additive Manufacturing of Metallic Components	4 CP	Zanger
T-CIWVT-110902	Additive Manufacturing for Process Engineering - Examination	5 CP	Klahn
T-MACH-114753	Advanced Ceramic Processing	4 CP	Pagnan Furlan
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CP	Ulrich
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-MACH-114015	Energy Efficient and Sustainable Tribological Systems (in German)	4 CP	Dienwiebel
T-MACH-114016	Energy Efficient and Sustainable Tribological Systems	4 CP	Dienwiebel
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CP	Henning
T-MACH-114610	Failure Analysis	4 CP	Bauer
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CP	Henning
T-MACH-105157	Foundry Technology	4 CP	Günther, Klan
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CP	Schell
T-MACH-113598	High Temperature Corrosion	4 CP	Gorr
T-MACH-105459	High Temperature Materials	4 CP	Heilmaier
T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CP	Pundt
T-MACH-113698	Beyond Conventional Materials - Metamaterials & Architected Structures	4 CP	Bauer
T-MACH-112763	Laser Material Processing	4 CP	Schneider
T-MACH-114439	Lightweight Design Workshop: Simulation and Manufacturing	4 CP	Kärger, Liebig
T-MACH-114956	Non-ferrous Metals and Alloys	4 CP	Heilmaier, White
T-MACH-111391	Phase Transformations in Materials	4 CP	Heilmaier
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-113575	Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components	4 CP	Zanger
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CP	Schell
T-MACH-105724	Failure Analysis (in German)	4 CP	Greiner, Schneider
T-MACH-105170	Welding Technology	4 CP	Farajian
T-MACH-112106	Fatigue of Materials	4 CP	Guth
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures	4 CP	Kärger
T-MACH-111257	Superhard Thin Film Materials	4 CP	Ulrich
T-MACH-102103	Superhard Thin Film Materials	4 CP	Ulrich
T-MACH-105362	Technology of Steel Components	4 CP	Schulze
T-MACH-111459	Thermophysics of Advanced Materials	4 CP	Sergeev
T-MACH-114014	Thin Films – Structure, Thermodynamics, Applications in Energy Technologies	4 CP	Wagner
T-MACH-105177	Metal Forming	4 CP	Herlan

T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (in German)	4 CP	Pundt
T-MACH-105211	Materials of Lightweight Construction	4 CP	Liebig
T-MACH-110165	Materials in Additive Manufacturing	4 CP	Dietrich, Schulze
T-MACH-110937	Materials Recycling and Sustainability	4 CP	Liebig
T-MACH-114968	Non-destructive Materials Testing	6 CP	Dietrich
Compulsory Elective Subjects Courseworks (Election: between 0 and 4 credits)			
T-MACH-105651	Biomechanics: Design in Nature and Inspired by Nature	4 CP	Mattheck
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups	4 CP	Dietrich
T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course	4 CP	Wagner
T-CIWVT-110903	Practical in Additive Manufacturing for Process Engineering	1 CP	Klahn
T-MACH-105178	Practical Course Technical Ceramics	4 CP	Schell
T-MACH-114609	Lab Course in Failure Analysis	4 CP	Greiner
T-MACH-112942	Hydrogen in Materials – Exercises and Lab Course (in German)	4 CP	Wagner

Assessment
The success controls usually include five oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses.

Prerequisites
None

Competence Goal
Students are familiar with the specific property portfolio of structural materials. They are able to assess different classes of materials against each other. Further, they are enabled to select suitable structural materials based on possible applications and parts.

Because of the great variety of selection possibilities further details may be taken out of the specific course descriptions contained in this module.

Content
Because of the great variety of selection possibilities the contents may be taken out of the specific course descriptions contained in this module.

Workload
The usual work load is:

presence time: 110 h

preparation and rework time: 490 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.12 Module: Structural Materials (40CP) [M-MACH-107577]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: Specialization

Credits	Grading	Recurrence	Duration	Language	Level	Version
40 CP	graded	Each term	2 terms	German	4	2

Compulsory Elective Subjects Examinations (Election: at least 32 credits)			
T-MACH-113985	Additive Manufacturing of Metallic Components	4 CP	Zanger
T-CIWVT-110902	Additive Manufacturing for Process Engineering - Examination	5 CP	Klahn
T-MACH-114753	Advanced Ceramic Processing	4 CP	Pagnan Furlan
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CP	Ulrich
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-MACH-114015	Energy Efficient and Sustainable Tribological Systems (in German)	4 CP	Dienwiebel
T-MACH-114016	Energy Efficient and Sustainable Tribological Systems	4 CP	Dienwiebel
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CP	Henning
T-MACH-114610	Failure Analysis	4 CP	Bauer
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CP	Henning
T-MACH-105157	Foundry Technology	4 CP	Günther, Klan
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CP	Schell
T-MACH-113598	High Temperature Corrosion	4 CP	Gorr
T-MACH-105459	High Temperature Materials	4 CP	Heilmaier
T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	4 CP	Pundt
T-MACH-113698	Beyond Conventional Materials - Metamaterials & Architected Structures	4 CP	Bauer
T-MACH-112763	Laser Material Processing	4 CP	Schneider
T-MACH-114439	Lightweight Design Workshop: Simulation and Manufacturing	4 CP	Kärger, Liebig
T-MACH-114956	Non-ferrous Metals and Alloys	4 CP	Heilmaier, White
T-MACH-111391	Phase Transformations in Materials	4 CP	Heilmaier
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-113575	Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components	4 CP	Zanger
T-MACH-102157	High Performance Powder Metallurgy Materials	4 CP	Schell
T-MACH-105724	Failure Analysis (in German)	4 CP	Greiner, Schneider
T-MACH-105170	Welding Technology	4 CP	Farajian
T-MACH-112106	Fatigue of Materials	4 CP	Guth
T-MACH-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures	4 CP	Kärger
T-MACH-111257	Superhard Thin Film Materials	4 CP	Ulrich
T-MACH-102103	Superhard Thin Film Materials	4 CP	Ulrich
T-MACH-105362	Technology of Steel Components	4 CP	Schulze
T-MACH-111459	Thermophysics of Advanced Materials	4 CP	Sergeev
T-MACH-114014	Thin Films – Structure, Thermodynamics, Applications in Energy Technologies	4 CP	Wagner
T-MACH-105177	Metal Forming	4 CP	Herlan

T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (in German)	4 CP	Pundt
T-MACH-105211	Materials of Lightweight Construction	4 CP	Liebig
T-MACH-110165	Materials in Additive Manufacturing	4 CP	Dietrich, Schulze
T-MACH-110937	Materials Recycling and Sustainability	4 CP	Liebig
T-MACH-114968	Non-destructive Materials Testing	6 CP	Dietrich
Compulsory Elective Subjects Courseworks (Election: between 0 and 8 credits)			
T-MACH-105651	Biomechanics: Design in Nature and Inspired by Nature	4 CP	Mattheck
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups	4 CP	Dietrich
T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course	4 CP	Wagner
T-CIWVT-110903	Practical in Additive Manufacturing for Process Engineering	1 CP	Klahn
T-MACH-105178	Practical Course Technical Ceramics	4 CP	Schell
T-MACH-114609	Lab Course in Failure Analysis	4 CP	Greiner
T-MACH-112942	Hydrogen in Materials – Exercises and Lab Course (in German)	4 CP	Wagner

Assessment
The success controls usually include ten oral exams of about 25 minutes duration per exam. However, number, type and scope of the success controls can vary according to the individual choice of courses.

Prerequisites
None

Competence Goal
Students are familiar with the specific property portfolio of structural materials. They are able to assess different classes of materials against each other. Further, they are enabled to select suitable structural materials based on possible applications and parts.

Because of the great variety of selection possibilities further details may be taken out of the specific course descriptions contained in this module.

Content
Because of the great variety of selection possibilities the contents may be taken out of the specific course descriptions contained in this module.

Workload
The usual work load is:

presence time: 220 h

preparation and rework time: 980 h

The workload composite however may vary according to the individually choice of courses.

Teaching and Learning Methods
Lectures, Lab Courses, Seminars

Level 4

M 5.13 Module: Supplementary Studies on Science, Technology and Society [M-FORUM-106753]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: Additional Examinations

Credits	Grading	Recurrence	Duration	Language	Level	Version
16 CP	graded	Each term	3 terms	German	4	1

Election Notes
Students have to self-record the achievements obtained in the Supplementary Studies on Science, Technology and Society in their study plan. FORUM (formerly ZAK) records the achievements as "non-assigned" under "ÜQ/SQ-Leistungen". Further instructions on self-recording of achievements can be found in the FAQ at https://campus.studium.kit.edu/ and on the FORUM homepage at https://www.forum.kit.edu/english/. The title of the examination and the amount of credits override the modules placeholders.

If you want to use FORUM achievements for both your Interdisciplinary Qualifications and for the Supplementary Studies, please record them in the Interdisciplinary Qualifications first. You can then get in contact with the FORUM study services (stg@forum.kit.edu) to also record them in your Supplementary Studies.

In the Advanced Unit you can choose examinations from three subject areas: "About Knowledge and Science", "Science in Society" and "Science in Social Debates". It is advised to complete courses from each of the three subject areas in the Advanced Unit.

To self-record achievements in the Advanced Unit, you have to select a free placeholder partial examination first. The placeholders' title do *not* affect which achievements the placeholder can be used for!

Mandatory			
T-FORUM-113578	Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration	2 CP	Mielke, Myglas
T-FORUM-113579	Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration	2 CP	Mielke, Myglas
Advanced Unit Supplementary Studies on Science, Technology and Society (Election: at least 12 credits)			
T-FORUM-113580	Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration	3 CP	Mielke, Myglas
T-FORUM-113581	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration	3 CP	Mielke, Myglas
T-FORUM-113582	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration	3 CP	Mielke, Myglas
Mandatory			
T-FORUM-113587	Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society	0 CP	Mielke, Myglas

Assessment
The monitoring is explained in the respective partial achievement.

They are composed of:
- Protocols
- Reflection reports
- Presentations
- Preparation of a project work
- An individual term paper
- An oral examination
- A written exam

Upon successful completion of the supplementary studies, graduates receive a graded report and a certificate issued by the FORUM.

Prerequisites
The course is offered during the course of study and does not have to be completed within a defined period. Enrollment is required for all assessments of the modules in the supplementary studies.
Participation in the supplementary studies is regulated by § 3 of the statutes. KIT students register for the supplementary studies by selecting this module in the student portal and booking a performance themselves. Registration for courses, assessments, and exams is regulated by § 8 of the statutes and is usually possible shortly before the start of the semester.
The course catalog, module description (module manual), statutes (study regulations), and guidelines for creating the various written performance requirements can be downloaded from the FORUM homepage at https://www.forum.kit.edu/begleitstudium-wtg.php.

Registration and exam modalities
PLEASE NOTE:
Registration on the FORUM, i.e. additionally via the module selection in the student portal, enables students to receive up-to-date information about courses or study modalities. In addition, registering on the FORUM ensures that you have proof of the credits you have earned. As it is currently (as of winter semester 24-25) not yet possible to continue additional credits acquired in the Bachelor's programme electronically in the Master's programme, we strongly advise you to digitally secure the credits you have earned by archiving the Bachelor's transcript of records yourself and by registering on FORUM.
In the event that a transcript of records of the Bachelor's certificate is no longer available - we can only assign the achievements of registered students and thus take them into account when issuing the certificate.

Competence Goal
Graduates of the Supplementary Studies on Science, Technology, and Society gain a solid foundation in understanding the interplay between science, the public, business, and politics. They develop practical skills essential for careers in media, political consulting, or research management. The program prepares them to foster innovation, influence social processes, and engage in dialogue with political and societal entities. Participants are introduced to interdisciplinary perspectives, encompassing social sciences and humanities, to enhance their understanding of science, technology, and society. The teaching objectives of this supplementary degree program include equipping participants with both subject-specific knowledge and insights from epistemological, economic, social, cultural, and psychological perspectives on scientific knowledge and its application in various sectors. Students are trained to critically assess and balance the implications of their actions at the intersection of science and society. This training prepares them for roles as students, researchers, future decision-makers, and active members of society.

Through the program, participants learn to contextualize in-depth content within broader frameworks, independently analyze and evaluate selected course materials, and communicate their findings effectively in both written and oral formats. Graduates are adept at analyzing social issues and problem areas, reflecting on them critically from a socially responsible and sustainable standpoint.

Content
The Supplementary Studies on Science, Technology and Society can be started in the 1st semester of the enrolled degree programme and is not limited in time. The wide range of courses offered by FORUM makes it possible to complete the program usually within three semesters. The supplementary studies comprises 16 or more credit points (LP). It consists of **two modules: the Basic Module (4 LP) and the Advanced Module (12 LP).**

The **basic Module** comprises the compulsory courses ‘Lecture Series Supplementary Studies on Science, Technology and Society’ and a basic seminar with a total of 4 LP.

The **Advanced Module** comprises courses totalling 12 LP in the humanities and social sciences subject areas ‘On Knowledge and Science’, ‘Science in Society’ and ‘Science in Public Debates’. The allocation of courses to the accompanying study programme can be found on the homepage https://www.forum.kit.edu/wtg-aktuelland in the printed FORUM course catalogue.

The 3 thematic subject areas:

Subject area 1: About Knowledge and Science

This is about the internal perspective of science: students explore the creation of knowledge, distinguishing between scientific and non-scientific statements (e.g., beliefs, pseudo-scientific claims, ideological statements), and examining the prerequisites, goals, and methods of knowledge generation. They investigate how researchers address their own biases, analyze the structure of scientific explanatory and forecasting models in various disciplines, and learn about the mechanisms of scientific quality assurance.

After completing courses in the "Knowledge and Science" area, students can critically reflect on the ideals and realities of contemporary science. They will be able to address questions such as: How robust is scientific knowledge? What are the capabilities and limitations of predictive models? How effective is quality assurance in science, and how can it be improved? What types of questions can science answer, and what questions remain beyond its scope?

Subject area 2: Science in Society

This focuses on the interactions between science and different areas of society, such as how scientific knowledge influences social decision-making and how social demands impact scientific research. Students learn about the specific functional logics of various societal sectors and, based on this understanding, estimate where conflicts of goals and actions might arise in transfer processes—for example, between science and business, science and politics, or science and journalism. Typical questions in this subject area include: How and under what conditions does an innovation emerge from a scientific discovery? How does scientific policy advice work? How do business and politics influence science, and when is this problematic? According to which criteria do journalists incorporate scientific findings into media reporting? Where does hostility towards science originate, and how can social trust in science be strengthened?

After completing courses in the "Sciene in Society" area, students can understand and assess the goals and constraints of actors in different societal sectors. This equips them to adopt various perspectives of communication and action partners in transfer processes and to act competently at various social interfaces with research in their professional lives.

Subject area 3: Science in Public Debates

The courses in this subject area provide insights into current debates on major social issues such as sustainability, digitalization, artificial intelligence, gender equality, social justice, and educational opportunities. Public debates on complex challenges are often polarized, leading to oversimplifications, defamation, or ideological thinking. This can hinder effective social solution-finding processes and alienate people from the political process and from science. Debates about sustainable development are particularly affected, as they involve a wide range of scientific and technological knowledge in both problem diagnosis (e.g., loss of biodiversity, climate change, resource consumption) and solution development (e.g., nature conservation, CCS, circular economy).

By attending courses in "Science in Public Debates," students are trained in an application-oriented way to engage in factual debates—exchanging arguments, addressing their own prejudices, and handling contradictory information. They learn that factual debates can often be conducted more deeply and with more nuance than is often seen in public discourse. This training enables them to handle specific factual issues in their professional lives independently of their own biases and to be open to differentiated, fact-rich arguments.

Supplementary credits:
Additional LP (supplementary work) totalling a maximum of 12 LP can also be acquired from the complementary study programme (see statutes for the WTG complementary study programme § 7). § 4 and § 5 of the statutes remain unaffected by this. These supplementary credits are not included in the overall grade of the accompanying study programme. At the request of the participant, the supplementary work will be included in the certificate of the accompanying study programme and marked as such. Supplementary coursework is listed with the grades provided for in § 9.

Module Grade Calculation
The overall grade of the supplementary course is calculated as a credit-weighted average of the grades that were achieved in the advanced module.

Additional Information
Climate change, biodiversity crisis, antibiotic resistance, artificial intelligence, carbon capture and storage, and gene editing are just a few areas where science and technology can diagnose and address numerous social and global challenges. The extent to which scientific findings are considered in politics and society depends on various factors, such as public understanding and trust, perceived opportunities and risks, and ethical, social, or legal considerations.
To enable students to use their expertise as future decision-makers in solving social and global challenges, we aim to equip them with the skills to navigate the interfaces between science, business, and politics competently and reflectively. In the Supplementary Studies, they acquire foundational knowledge about the interactions between science, technology, and society.

They learn:
- How reliable scientific knowledge is produced,
- how social expectations and demands influence scientific research, and
- how scientific knowledge is adopted, discussed, and utilized by society.

The program integrates essential insights from psychology, philosophy, economics, social sciences, and cultural studies into these topics. After completing the supplementary studies programme, students can place the content of their specialized studies within a broader social context. This prepares them, as future decision-makers, to navigate competently and reflectively at the intersections between science and various sectors of society, such as politics, business, or journalism, and to contribute effectively to innovation processes, public debates, or political decision-making.

Workload
The workload is made up of the number of hours of the individual modules:

- Basic Module approx. 120 hours
- Advanced Module approx. 360 hours

> Total: approx. 480 hours

In the form of supplementary services, up to approximately 360 hours of work can be added.

Recommendations
It is recommended to complete the supplementary study program in three or more semesters, beginning with the lecture series on science, technology, and society in the summer semester. Alternatively, you can start with the basic seminar in the winter semester and then attend the lecture series in the summer semester.

Courses in the Advanced Module can be taken simultaneously. It is also advised to complete courses from each of the three subject areas in the advanced unit.

Teaching and Learning Methods
- Lectures
- Seminars/Project Seminars
- Workshops

M 5.14 Module: Technology and Society [M-MACH-106939]

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

Part of: Interdisciplinary Complementation

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

Technology and Society (Election: at least 4 credits)			
T-FORUM-113967	Introduction to Philosophy of Science for Beginners and Advanced Students of all Disciplines	2 CP	
T-WIWI-114140	Emissions into the Environment	3 CP	Karl
T-WIWI-114139	Energy and Environment	3 CP	Karl
T-GEISTSOZ-115018	History of Technology and the Environment for Mechanical Engineering Students	4 CP	Popplow
T-MACH-113883	Introduction to Philosophy of Technology	2 CP	Hillerbrand
T-MACH-114962	Introduction to Philosophy of Technology - Essay	1 CP	Hillerbrand
T-MACH-114961	Introduction to Philosophy of Technology - Homework	1 CP	Hillerbrand
T-INFO-114132	Human-Machine-Interaction in Anthropomatics: Basics	4 CP	Beyerer, van de Camp
T-MACH-114855	Ressources for the Energy Transition	2 CP	Riegler
T-FORUM-113972	Scientific Literacy. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society	2 CP	
T-GEISTSOZ-113951	History of Technology and the Environment for Mechanical Engineering Students	4 CP	Popplow
T-MACH-113884	Technology Assessment and its Normative Basis	2 CP	Hillerbrand
T-WIWI-114119	Transport Economics	4 CP	Mitusch, Szimba
T-WIWI-114396	Environmental and Resource Policy	2 CP	Walz
T-FORUM-113954	Scientific Empowerment. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society	2 CP	
T-GEISTSOZ-115075	Foundations of Technology Ethics	2 CP	Derpmann
T-GEISTSOZ-115108	Energy Ethics	2 CP	Frigo

Assessment
See individual course description

Prerequisites
none

Competence Goal
In this module, students gain an understanding of the interplay between technology and society. They are enabled to assess, critically question and evaluate the consequences of their decisions and actions on society and the environment, thus acquiring ethical reflection skills. For example, they can determine the benefits and risks of new technologies and carry out a technology assessment, recognize the emergence of innovation and communicate science and research with various groups from outside the field.

Content
See individual course description

Module Grade Calculation
The module is ungraded and remains ungraded even if a graded course is chosen.

Additional Information
We suggest that the 2-CR-seminars in this module should be combined with the modular online course T-ETIT-111923 - Technology Ethics - ARs ReflecTIonis and not with any other 2-CR- seminars from this module.

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

Teaching and Learning Methods
Lectures and practices; self-study

M 5.15 Module: Thermodynamics and Kinetics [M-MACH-107324]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering

Part of: Materials Science Major Course

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each term	1 term	German/English	4	1

Election Notes
The module can be passed either in English or in German. The selection is set by the combined allocation of the corresponding courses in English or in German including all associated assessments. The courses in English and in German are mutually exclusive. The preparatory courses (“exercises“) are a prerequisite for the superordinate course in the same teaching language.

Compulsory Elective Subjects (Election: 2 items as well as 7 credits)			
T-MACH-114534	Exercises for Thermodynamic and Kinetic Fundamentals of Material Science	2 CP	Gorr
T-MACH-114532	Thermodynamic and Kinetic Fundamentals of Material Science	5 CP	Gorr
T-MACH-114535	Exercises for Thermodynamic and Kinetic Fundamentals of Material Science	2 CP	Gorr
T-MACH-114533	Thermodynamic and Kinetic Fundamentals of Material Science	5 CP	Gorr

Assessment
The assessment consists of a certificate and an oral exam (about 30 minutes).

Prerequisites
none

Competence Goal
The students know about heterogeneous equilibria (materials constitution, phase diagrams) of binary and fundamental ternary materials systems. They can analyze the correlated thermodynamic properties of multiphase materials involving condensed phases and gas phases, respectively. The learned relationships are deepened by means of examples for metallic alloys. The students acquire fundamental knowledge about diffusion mechanisms and the chemical potential as the driving force for diffusion. They learn the diffusion Fick’s laws as well as their solutions. The students can analytically describe the particle nucleation and growth as well as explain the Kirkendall effect.

Content
1. Binary phase diagrams
2. Fundamental ternary phase diagrams
- Invariant ternary reactions
- Microstructural development in ternary systems
- Influence of intermetallic phases
3. Thermodynamics of solution phases
- Enthalpy, entropy, Gibbs free energy, chemical potentials
4. Modeling and calculation of phase diagrams
5. Diffusion mechanisms and Fick’s laws
6. Chemical potential as the driving force for diffusion
7. Particle nucleation and growth
8. Kirkendall effect

Module Grade Calculation
- The module grade is equal to the grade of the oral exam

Workload
The workload for the module “Thermodynamics and Kinetics” is 210 h per semester and consists of the presence during the lectures (21 h) and tutorials (12 h) as well as self-study for the lecture (114 h) and for the tutorials (63 h).

Teaching and Learning Methods
Lectures (Obligatory)
Tutorials (Obligatory)

Literature

- B. Predel, M. Hoch, M. Pool:
Phase Diagrams and Heterogeneous Equilibria: A Practical Introduction,
Springer, Berlin, Heidelberg (2010)
- D. R. F. West, N. Saunders: Ternary Phase Diagrams in Materials Science,
3rd edition, CRC Press (2017)
- A. Paul, T. Laurila, V. Vuorinen, S. Divinski, Thermodynamics, diffusion and the Kirkendall effect in solids, Springer International Publishing Switzerland, 2014; avaliable as e-book
- D. Gupta, Diffusion processes in advanced technological materials,William Andrew, Inc, 2005; avaliable as e-book

6 Module components

T 6.1 Module component: Introduction to Philosophy of Science for Beginners and Advanced Students of all Disciplines [T-FORUM-113967]

Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Version
Coursework	2 CP	pass/fail	3

Courses					
ST 2026	1130810	Philosophy of science for the curious	2 SWS	Seminar /	Roessing
Exams					
ST 2026	1200005-M	Philosophy of Science for the Curious			Mielke

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

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

V Philosophy of science for the curious

1130810, SS 2026, 2 SWS, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
This seminar is held in German.

Organizational issues
Anmeldung erforderlich über: https://plus.campus.kit.edu/signmeup/procedures/6099

T 6.2 Module component: Adaptive Optics [T-ETIT-107644]

Coordinators: Ph.D. Szymon Gladysz
Prof. Dr. Ulrich Lemmer

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2313724	Adaptive Optics	2 SWS	Lecture / 🗣	Gladysz
Exams					
WT 25/26	7313724	Adaptive Optics			Lemmer, Gladysz
ST 2026	7313724	Adaptive Optics			Lemmer, Gladysz

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

Assessment
Type of Examination: Oral examination

Duration of Examination: approx. 30 Minutes

Modality of Exam: The oral exam will be scheduled during the semester break.

The module grade is the grade of the oral exam.

Prerequisites
None.

Recommendations
Basic knowledge of statistics.

Workload
90 hours

T 6.3 Module component: Additive Manufacturing for Process Engineering - Examination [T-CIWVT-110902]

Coordinators: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2241020	Additive Manufacturing for Process Engineering	2 SWS	Lecture / 🗣	Klahn
Exams					
WT 25/26	7241020	Additive Manufacturing for Process Engineering - Examination			Klahn
ST 2026	7241020	Additive Manufacturing for Process Engineering - Examination			Klahn

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

Assessment
Oral examination lasting approx. 30 minutes.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-110903 - Practical in Additive Manufacturing for Process Engineering must have been passed.

T 6.4 Module component: Additive Manufacturing of Metallic Components [T-MACH-113985]

Coordinators: Prof. Dr.-Ing. Frederik Zanger
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2149671	Additive Manufacturing of Metallic Components	2 SWS	Lecture / 🗣	Zanger
Exams					
WT 25/26	76-T-MACH-113985	Additive Manufacturing of Metallic Components			Zanger

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

Assessment
Oral examination, duration approx. 30 minutes

Prerequisites
The following module component may not have started:

- T-MACH-114019 - Additive Fertigung metallischer Bauteile: Designoptimierung und Herstellung

Additional Information
The course is offered in German.

Workload
120 hours

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

V Additive Manufacturing of Metallic Components

Lecture (V)
On-Site

2149671, WS 25/26, 2 SWS, Language: German, Open in study portal

Content

The course “Additive Manufacturing of Metallic Components” teaches the theoretical fundamentals of metallic additive manufacturing, particularly using the example of the laser-based process powder bed fusion (PBF-LB/M). It thus provides the ideal prerequisite for the course “Project Internship Additive Manufacturing: Design Optimization and Manufacturing of Metallic Components.”

The course covers the underlying mechanisms and the necessary steps in the additive process chain for metallic components. Other processes for manufacturing metallic components using additive manufacturing methods are also discussed. Students will learn about the following topics:

- Structure and function of a PBF-LB/M system
- Influence of process parameters on the quality of components manufactured in the PBF-LB/M process
- Design for additive manufacturing
- Options for simulation assistance in the process chain
- Process monitoring and quality assurance in additive manufacturing
- Downstream processes for adjusting the required component state
- Quality control in additive manufacturing
- Fundamentals and possibilities of directed energy deposition, binder jetting, and bath-based photopolymerization processes.

Learning Outcomes:

Students ...

- are able to explain the basic principles of the laser-based additive manufacturing processes powder bed fusion and directed energy deposition, as well as the two processes binder jetting and bath-based photopolymerization.
- can describe the characteristics and areas of application of the four processes mentioned above.
- can describe the creation of a product along the entire additive process chain (CAD, simulation, construction job preparation, CAM) from the initial idea to production using the example of the powder bed fusion process.
- are able to discuss the development process for components that are optimized for additive manufacturing.
- can explain in detail the mechanisms behind the powder bed fusion process and derive measures for improving the process.
- can evaluate and select options for post-processing additively manufactured components based on their requirements.
- are able to name the most important methods for quality assurance in additive manufacturing and the relevant standards.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature

Medien:

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

Media:

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

T 6.5 Module component: Advanced Ceramic Processing [T-MACH-114753]

Coordinators: Prof. Dr. Kaline Pagnan Furlan
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2126730	Advanced ceramics processing (EN)	2 SWS	Lecture / Blended	Pagnan Furlan
Exams					
WT 25/26	76-T-MACH-114753	Advanced Ceramic Processing			Pagnan Furlan

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

Assessment
Written Exam. 90 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 Advanced ceramics processing (EN)

2126730, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
This course explores the engineering principles and techniques used to transform raw ceramic powders into high-performance advanced ceramics. Students learn how particle characteristics, forming strategies, and processing parameters influence microstructure and final properties. Emphasis is placed on understanding the interplay between materials design, processing control, and functional performance, supported by hands-on exercises and problem-solving sessions.

Organizational issues
Notice: the course starts on 04.11.2025!

Literature
1. (To refresh concepts from Fundamentals of Materials Engineering) Callister William D., Rethwisch David G., Fundamentals of materials science and engineering. Hoboken, N.J: Wiley. 2008. https://katalog.bibliothek.kit.edu/cgi-bin/koha/opac-detail.pl?biblionumber=309052&query_desc=callister

2. Richerson David W., Modern ceramic engineering. Boca Raton, FL: CRC Press. 2018. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&db=nlabk&AN=1802218 *

3. Bansal Narottam P. and Boccaccini Aldo R., Ceramics and composites processing methods. Hoboken, N.J: Wiley. 2012. https://ebookcentral.proquest.com/lib/karlsruhetech/detail.action?docID=817471 *

* Access possible via KIT Network.

6.6 Module component: Applied Chemistry [T-CHEMBIO-100302]

Coordinators: Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Prof. Dr. Michael Meier
Prof. Dr. Patrick Théato

Organisation: KIT Department of Chemistry and Biosciences

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	5400	Angewandte Chemie	3 SWS	Lecture / Practice / 🗣	Grunwaldt, Deutschmann, Théato, Schmitt, Voll
Exams					
WT 25/26	7100006	Applied Chemistry, 2nd written exam			Grunwaldt, Théato, Deutschmann, Meier
ST 2026	7100019	Applied Chemistry, 1st written exam			Deutschmann, Grunwaldt, Meier, Théato

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

T 6.7 Module component: Applied Materials Simulation [T-MACH-110929]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103712 - Simulation

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

Courses					
ST 2026	2182616	Applied Materials Simulation	4 SWS	Lecture / Practice / 🗣	Gumbsch, Weygand
Exams					
WT 25/26	76-T-MACH-110929	Applied Materials Simulation			Gumbsch, Schulz
ST 2026	76-T-MACH-110929	Applied Materials Simulation			Gumbsch

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 Exercises for Applied Materials Simulation is the condition for the admittance to the oral exam in Applied Materials Simulation.

T-MACH-107671 – Übungen zu Angewandte Werkstoffsimulation has not been started.

T-MACH-105527 – Angewandte Werkstoffsimulation has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110928 - Exercises for Applied Materials Simulation must have been passed.
2. The module component T-MACH-105527 - Applied Materials Simulation must not have been started.
3. The module component T-MACH-107671 - Exercises for Applied Materials Simulation 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 Applied Materials Simulation

2182616, SS 2026, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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

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

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103712 - Simulation

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

Courses					
ST 2026	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice / 🖥	Gumbsch, Weygand
Exams					
WT 25/26	76-T-MACH-105527	Applied Materials Modelling			Gumbsch, Schulz
ST 2026	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.
2. The module component T-MACH-110929 - Applied Materials Simulation must not have been started.
3. The module component T-MACH-110928 - Exercises for Applied Materials Simulation 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 Applied Materials Simulation

2182614, SS 2026, 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 6.9 Module component: Applied Surface Materials [T-MACH-114646]

Coordinators: Prof. Dr. Anass Benayad
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2181550	Applied Surface Materials	2 SWS	Lecture / 🗣	Benayad
Exams					
WT 25/26	76-T-MACH-114646	Applied Surface Materials			Benayad

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

Assessment
oral exam, duration: ca. 30 minutes

Prerequisites
none

Recommendations
knowledge of solid-state chemistry, solid-state physics and materials science is recommended

Additional Information
The course is offered in English.

Workload
120 hours

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

V Applied Surface Materials

2181550, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The role of surface and near-surface regions of materials is crucial and one of the striking features of modern technology. When Nobel laureate Herbert Kroemer coined that “the interface is the device”, he referred to the engineering of material surfaces properties that brought the success of modern devices. Exhibiting a wide range of phenomena such as magnetism, superconductivity, ionic and electron transport etc., materials-based surfaces are finding the applications including energy harvesting, energy storage, information storage, microelectronics and more.

Where does this broad range of surface properties come from? Which analytical methods are used to qualify and quantify the surface properties? What are the characterization protocols for tracking the surface properties in the devices?

The students learn:

- The conceptual framework that underlies the microscopic and atomistic theory of surface properties.
- Transport properties of surfaces and applications
- Surface characterization from pristine material to applied devices

knowledge of solid-state chemistry, solid-state physics and materials science is recommended

regular attendance: 21 hours
self-study: 99 hours

oral exam, duration: ca. 30 minutes, no notes

6.10 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-107326 - MINT Elective Module

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 6.11 Module component: Automated Visual Inspection and Image Processing [T-INFO-101363]

Coordinators: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2424169	Automated Visual Inspection and Image Processing	4 SWS	Lecture / 🗣	Beyerer
Exams					
WT 25/26	7500008	Automated Visual Inspection and Image Processing			Beyerer
ST 2026	7500003	Automated Visual Inspection and Image Processing			Beyerer

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

Assessment
Success is assessed in the form of a written examination (usually lasting 60 minutes) in accordance with Section 4 (2) No. 1 SPO.

Prerequisites
None.

Recommendations
Basic knowledge of optics and signal processing is helpful.

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

V Automated Visual Inspection and Image Processing

2424169, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Topics covered:

- sensors and concepts for image acquisition
- light and colour
- image signals (system theory, Fourier transformation, stochastic processes)
- excursion to wave optics
- pre-processing and image enhancement
- image restoration
- segmentation
- morphological image processing
- texture analysis
- detection
- image pyramids, multi scale analysis and wavelet-transform

Educational objective:

- Students have a sound knowledge regarding the basic concepts and methods of image processing (pre-processing and image enhancement, image restoration, image segmentation, morphological filtering, texture analysis, detection, image pyramids, multi-scale analysis and the wavelet transform)
- Students are in the position to work out and to evaluate solution concepts for problems of automated visual inspection
- Students have a sound knowledge of the different sensors and methods for the acquisition of image data as well as of the relevant optical principles
- Students know different concepts to describe image data and they know the essential system theoretical concepts and interrelations

Organizational issues

Die Erfolgskontrolle wird in der Modulbeschreibung erläutert.

Empfehlungen:

Grundkenntnisse der Optik und der Signalverarbeitung sind hilfreich.

Literature

Weiterführende Literatur

- R. C. Gonzalez und R. E. Woods, Digital Image Processing, Prentice-Hall, Englewood Cliffs, New Jersey, 2002
- B. Jähne, Digitale Bildverarbeitung, Springer, Berlin, 2002

T 6.12 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-102203	Automotive Engineering I			Gießler
ST 2026	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 (in German) 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 6.13 Module component: Automotive Engineering I (in German) [T-MACH-100092]

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

Part of: M-MACH-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-100092	Automotive Engineering			Gießler
ST 2026	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

6.14 Module component: Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113579]

Coordinators:	Dr. Christine Mielke Christine Myglas
Organisation:	General Studies. Forum Science and Society (FORUM)
Part of:	M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	1

Assessment
Study achievement in the form of a presentation or a term paper or project work in the selected course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
It is recommended that the basic seminar be completed during the same semester as the lecture series "Science in Society". If it is not possible to attend the lecture series and the basic seminar in the same semester, the basic seminar can also be attended in the semesters before the lecture series.
However, attending courses in the advanced unit before attending the basic seminar should be avoided.

T 6.15 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	7100050	Batteries and Fuel Cells			Ehrenberg

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

Assessment
Oral exam, about 25 minutes

Prerequisites
The following partial achievements must not have started:

T-ETIT-113986 – Batteries, Fuel Cells, and Electrolysis

T-ETIT-100983 - Batterien und Brennstoffzellen

T-ETIT-114097 - Batterien, Brennstoffzellen und ihre Systeme

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-113986 - Batteries, Fuel Cells, and Electrolysis must not have been started.

Workload
120 hours

T 6.16 Module component: Batteries, Fuel Cells, and Electrolysis [T-ETIT-113986]

Coordinators: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2304240	Batteries, Fuel Cells and Electrolysis	2 SWS	Lecture /	Krewer
WT 25/26	2304241	Practical Exercise to 2304240 Batteries, Fuel Cells and Electrolysis	2 SWS	Practice /	Krewer, Sonder
Exams					
WT 25/26	7304240	Batteries, Fuel Cells, and Electrolysis			Krewer
ST 2026	7304240	Batteries, Fuel Cells, and Electrolysis			Krewer

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

Assessment
Success control takes place in the form of a graded written examination lasting 120 minutes.

Prerequisites
The following module components must not have started:

- T-CHEMBIO-112316 - Batteries and Fuel Cells
- T-ETIT-100983 - Batterien und Brennstoffzellen
- T-ETIT-114097 - Batterien, Brennstoffzellen und ihre Systeme

The following module components **must** have started:

- T-ETIT-114957 - Batteries, Fuel Cells, and Electrolysis - Group Project

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CHEMBIO-112316 - Batteries and Fuel Cells must not have been started.
2. The module component T-ETIT-114957 - Batteries, Fuel Cells, and Electrolysis - Group Project must have been started.

Additional Information
For details on content and qualification objectives see "M-ETIT-107005 - Batteries, Fuel Cells, and Electrolysis".

The course is offered in English.

Workload
150 hours

T 6.17 Module component: Batteries, Fuel Cells, and Electrolysis - Group Project [T-ETIT-114957]

Coordinators: Prof. Dr.-Ing. Ulrike Krewer

Organisation: KIT Department of Electrical Engineering and Information Technology
KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Assessment
Success control takes place in the form of an ungraded written technical report (approx. 7-10 pages).

Prerequisites
none

Additional Information
For details on content and qualification objectives see "M-ETIT-107005 - Batteries, Fuel Cells, and Electrolysis".

The course is offered in English.

Workload
30 hours

T 6.18 Module component: Beyond Conventional Materials - Metamaterials & Architected Structures [T-MACH-113698]

Coordinators: Jun.-Prof. Dr. Jens Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2186100	Beyond Conventional Materials - Metamaterials & Architected Structures	2 SWS	Lecture / Blended	Bauer
Exams					
WT 25/26	76-T-MACH-113698	Beyond Conventional Materials - Metamaterials & Architected Structures			Bauer

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

Assessment
oral examination (approx. 30 min)

no tools or reference materials

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 Beyond Conventional Materials - Metamaterials & Architected Structures

2186100, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
Conventional material design focuses on engineering the chemistry and microstructure of solids. Metamaterials go beyond these classical approaches. They are artificial materials that are built from spatially structured building blocks, like lattice-truss architectures. The integration of these rational architectures at the material level grants metamaterials unique unconventional properties which are inaccessible with classical material designs.

The course covers the fundamentals of the mechanics of different metamaterial architectures, discusses design principles and applicable fabrication techniques from the macro- to the nanoscale, as well as their interdependency, and considers emerging application scenarios in medicine, aerospace, microsystem technology, and mobility.

The students learn

- to design beam, shell and plate-based spatial architectures, such as for extreme strength & stiffness, programmable/adaptive behaviors and negative effective properties.
- to mathematically describe and predict the mechanical behavior of such architectural designs.
- the fundamentals of applicable fabrication techniques, including foaming, assembly and 3D-printing, and their design and material implications
- the relationship between architecture & size and how micro- and nanoscale architectures can leverage extreme physical size effects.

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam: ca. 30 minutes

no tools or reference materials

Literature
Gibson, L. J. & Ashby, M. F. Cellular Solids: Structure and properties. (Cambridge Univ. Pr., 2001).

Fleck, N. A., Deshpande, V. S. & Ashby, M. F. Micro-architectured materials: past, present and future. Proc. R. Soc. A Math. Phys. Eng. Sci. 466, 2495–2516 (2010).

Bauer, J. et al. Nanolattices: An Emerging Class of Mechanical Metamaterials. Adv. Mater. 29, 1701850 (2017).

Jiao, P., Mueller, J., Raney, J. R., Zheng, X. (Rayne) & Alavi, A. H. Mechanical metamaterials and beyond. Nat. Commun. 2023 141 14, 1–17 (2023).

T 6.19 Module component: Biomechanics: Design in Nature and Inspired by Nature [T-MACH-105651]

Coordinators: Prof. Dr. Claus Mattheck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	2181708	Biomechanics: Design in Nature and Inspired by Nature	3 SWS	/ 🗣	Mattheck
Exams					
WT 25/26	76-T-MACH-105651	Biomechanics: design in nature and inspired by nature			Mattheck

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

Assessment
Colloquium, ungraded.

Additional Information
The course is offered in German.

The number of participants is limited. Prior registration through ILIAS is necessary, In case of too many registrations, a selection (in accordance with SPO) will take place.

Before the registration in SP 26 (ME) or SP 01 (MSMT) the participation at the seminar must be confirmed.

Workload
120 hours

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

V Biomechanics: Design in Nature and Inspired by Nature

2181708, WS 25/26, 3 SWS, Language: German, Open in study portal **On-Site**

Content
* mechanics and growth laws of trees
* failure criteria and safety factors
* computer simulation of adaptive growth
* notches and damage case studies
* optimization inspired by nature
* structural shape optimization without computers
* universal shapes of nature
* fibre reinforces materials
* failure of trees, hillsides, dikes, walls and pipes

The students know and understand mechanical optimization schemes which are realized in nature. The students can analyze the derived thinking tools and can apply them for simple technical cases.

regular attendance: 30 hours
self-study: 90 hours

Organizational issues
Die Vorlesung findet als Kompaktvorlesung vom 4.-7.11.2025 im Campus Nord statt. Jeder Teilnehmer erhält ein Buch zum Inhalt der Vorlesung.

T 6.20 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber
ST 2026	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 6.21 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
WT 25/26	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber
ST 2026	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

2142883, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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, 07.09.2026, 8 - 10 Uhr; 10.21 Gottlieb-Daimler-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 6.22 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	2 SWS	Lecture / 🗣	Guber, Ahrens
Exams					
WT 25/26	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber
ST 2026	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

Lecture (V)
On-Site

2142879, SS 2026, 2 SWS, Language: German, Open in study portal

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

Organizational issues
Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.

schriftl. Prüfung: Mo, 28.09.2026, 8:00 - 10:00 Uhr; 10.21 Gottlieb-Daimler.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 6.23 Module component: CAE-Workshop [T-MACH-105212]

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

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
ST 2026	2147175	CAE-Workshop	3 SWS	Block / 🗣	Düser
Exams					
WT 25/26	76-T-MACH-105212	CAE-Workshop			Düser
ST 2026	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, 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.

V **CAE-Workshop**
2147175, SS 2026, 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.

T 6.24 Module component: Cell Biology [T-CIWVT-111062]

Coordinators: apl. Prof. Dr. Hans-Eric Gottwald
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2212113	Biology for Engineers - Cell Biology	2 SWS	Lecture / 🗣	Gottwald
Exams					
WT 25/26	7212113-V-ZELL	BING Cell Biology			Gottwald
ST 2026	7212113-V-ZELL	Cell Biology			Gottwald

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

Assessment
Written examination with a duration of 90 minutes (section 4, subsection 2 Nr. 1 SPO).

Prerequisites
None

T 6.25 Module component: Chemistry of Interfaces [T-BGU-115007]

Coordinators: Dr. rer. nat. Andreas Bogner
Dr. Peter Thissen

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	6211816	Chemistry of Interfaces	2 SWS	Lecture / 🗣	Thissen, Bogner
ST 2026	6211817	Exercises for Chemistry of Interfaces	2 SWS	Practice / 🗣	Thissen, Bogner

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

Assessment
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Additional Information
newly offered as from summer term 2026

Workload
180 hours

T 6.26 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			Kubach, Koch
ST 2026	76-T-MACH-102194	CO2-neutral combustion engines and their fuels I			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 6.27 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2134151	CO2-neutral combustion engines and their fuels II	3 SWS	Lecture / Practice / 🗣	Koch
Exams					
WT 25/26	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			Kubach, Koch
ST 2026	76-T-MACH-104609	Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II			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 2026, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

T 6.28 Module component: Combustion Technology [T-CIWVT-106104]

Coordinators: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2232010	Fundamentals of Combustion Technology	2 SWS	Lecture / 🗣	Trimis
WT 25/26	2232011	Exercises for 2232010 Fundamentals of Combustion Technology	1 SWS	Practice / 🗣	Trimis, und Mitarbeitende
Exams					
WT 25/26	7232010	Combustion Technology			Trimis
ST 2026	7232010	Combustion Technology			Trimis

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

Prerequisites
None

T 6.29 Module component: Communication Systems and Protocols [T-ETIT-101938]

Coordinators: Dr.-Ing. Jens Becker
Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2311616	Communication Systems and Protocols	2 SWS	Lecture / 🗣	Becker, Becker
ST 2026	2311618	Tutorial for 2311616 Communication Systems and Protocols	1 SWS	Practice / 🗣	Stammler
Exams					
WT 25/26	7311616	Communication Systems and Protocols			Becker, Becker

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

Assessment
The examination consists of a written examination of 120 min.

Prerequisites
none

Recommendations
Knowledge of the basics from the lecture "Digitaltechnik"is helpful.

T 6.30 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

Part of: Lightweight Design
M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture / 🗣	Henning
Exams					
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 2026, 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 6.31 Module component: Computational Condensed Matter Physics [T-PHYS-109895]

Coordinators: Prof. Dr. Wolfgang Wenzel
Organisation: KIT Department of Physics
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	12 CP	graded	Irregular	1 semesters	1

Courses					
ST 2026	4023161	Computational Condensed Matter Physics	4 SWS	Lecture / 🗣	Wenzel
ST 2026	4023162	Exercises to Computational Condensed Matter Physics	2 SWS	Practice / 🗣	Wenzel

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

T 6.32 Module component: Computational Elasticity [T-MACH-113989]

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

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each winter term	2

Courses					
WT 25/26	2161250	Computational Elasticity	2 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
WT 25/26	76-T-MACH-113989	Computational Elasticity			Böhlke, Langhoff

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

Assessment
oral examination, approx. 30 min.

Prerequisites
Coursework in *Tutorial Computational Elasticity* (T-MACH-114529) must be passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114529 - Tutorial Computational Elasticity must have been passed.

Recommendations
Knowledge of the contents of the course "Nonlinear Continuum Mechanics" (T-MACH-111026) of the focus field "Computational and applied Mechanics" (M-MACH-106976) are recommended.

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description "Computational Elasticity"

Workload
150 hours

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

V Computational Elasticity

2161250, WS 25/26, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- numerical solution of linear systems
- boundary value problems of linear elasticity
- solution methods of the boundary value problem of linear elasticity
- variational principles of linear elasticity
- finite-element-technology for linear static problems

Organizational issues
In Abstimmung mit den Teilnehmenden ist auch Deutsch als Sprache der Lehrveranstaltung möglich

Literature
Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002.
W. S. Slaughter: The linearized theory of elasticity. Birkhäuser, 2002.
J. Betten: Finite Elemente für Ingenieure 2, Springer, 2004.

T 6.33 Module component: Computational Inelasticity [T-MACH-113990]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	2

Courses					
ST 2026	2162296	Computational Inelasticity	2 SWS	Lecture / 🗣	Böhlke, Langhoff

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

Assessment
oral examination, approx. 30 min.

Prerequisites
Coursework in *Tutorial Computational Inelasticity* (T-MACH-114530) must be passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114530 - Tutorial Computational Inelasticity must have been passed.

Recommendations
Knowledge of the contents of the course "Nonlinear Continuum Mechanics" (T-MACH-111026) of the focus field "Computational and applied Mechanics" (M-MACH-106976) as well as of "Computational Elasticity" (T-MACH-113989) are recommended.

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description "Computational Inelasticity"

Workload
150 hours

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

V Computational Inelasticity
2162296, SS 2026, 2 SWS, Language: English, 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

Organizational issues
Mit Zustimmung aller Teilnehmenden kann die Lehrveranstaltung auch auf Deutsch gehalten werden.

Kenntnisse aus dem Kernfach "Nonlinear Continuum Mechanics" (T-MACH-111026) des Schwerpunkts "Computerbasierte und angewandte Mechanik" (M-MACH-106976) sowie aus "Computational Elasticity" (T-MACH-113989) werden empfohlen / Knowledge of the contents of the course "Nonlinear Continuum Mechanics" (T-MACH-111026) of the focus field "Computational and Applied Mechanics" (M-MACH-106976) as well as "Computational Elasticity" (T-MACH-113989) are recommended

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 6.34 Module component: Computational Photonics, without ext. Exercises [T-PHYS-106131]

Coordinators: Prof. Dr. Carsten Rockstuhl
Organisation: KIT Department of Physics
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	2

Courses					
WT 25/26	4023021	Computational Photonics	2 SWS	Lecture	Rockstuhl
WT 25/26	4023022	Übungen zu Computational Photonics	2 SWS	Practice	Rockstuhl, Nyman
Exams					
WT 25/26	7800095	Computational Photonics, without ext. Exercises			Rockstuhl

T 6.35 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	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 6.36 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice /	Mikut, Reischl
Exams					
WT 25/26	76-T-MACH-105694	Data Analytics for Engineers			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
150 hours

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

V Data Analytics for Engineers
2106014, SS 2026, 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 6.37 Module component: Data Science and Scientific Workflows [T-MACH-111588]

Coordinators: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2182741	Data Science and Scientific Workflows	3 SWS	Lecture / Practice / ✕	Weygand, Gumbsch

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

Assessment
written exam

Prerequisites
T-MACH-111603 must have been passed

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-111603 - Data Science and Scientific Workflows (Project) 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 Data Science and Scientific Workflows

2182741, SS 2026, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Cancelled

Content
The amount of data generated in scientific projects is increasing rapidly. The increase is partly due to the fact that new data-based evaluation methods allow a better and more precise analysis of scientific data. In addition, the linking of data provides new insights. This requires a systematic organization of data. The necessary knowledge of data science and computer science is equally required for both computer simulations and experimental investigations. The preparation/classification (e.g. electronic laboratory notebook) and structuring of data is a necessary step for their reuse. The lecture introduces the principles and software tools for the corresponding scientific workflows: Python and libraries, Jupyter notebook, shell scripts and documentation with git-tools. Applications in Python include statistical methods, machine learning techniques such as classification, artificial neural networks (ANN), convolutional neural networks (CNN), and Gaussian processes (GP) for simulation planning. Furthermore, an overview is given of database systems in materials research and the FAIR data principle (findability, accessibility, interoperability and reusability).

Objective:

Students will be able to

- organize and document data electronically
- handle data formats: simple, hierarchical ones
- deal with software management tools (git, gitlab)
- record scientific workflows in detail and ensure traceability
- use python-based libraries for data handling and analyses
- apply the fundamentals of machine learning

Detailed lecture content:

1. Introduction: the need for data science and computer science basics.
2. Programming and programming paradigms using Python
3. Software and data management: local and central management (git, gitlab)
4. Data processing: Automating tasks --- from scripts to workflow (examples from simulation and experiment)

5. Electronic lab book
6. Machine Learning: Classification, Neural Networks, Gaussian Process

Exercise:

The lecture material will be deepened in the exercises (exercise 1SWS).

Mode of examination:

- Project: Project topics from the areas
  - Material simulation and workflow
  - Data organization and analysis: from experiment or simulation
  - Presentation of the project in a 15 minute lecture + questions

- Preliminary examination performance: successful start to project work

Organizational issues
Die Vorlesung wurde ins Wintersemester verschoben.

Literature
Literatur:

- Handbuch Data Science, Hanser Verlag
- Effective Computation in Physics, Scopatz & Huff, O’Reilly 2015
- Python Data Science Handbook, J. VanderPlas, O’Reilly 2016.
- Materials Data Science, S. Sandfeld, Springer, 2024.

T 6.38 Module component: Data Science and Scientific Workflows (Project) [T-MACH-111603]

Coordinators: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2182741	Data Science and Scientific Workflows	3 SWS	Lecture / Practice / ✕	Weygand, Gumbsch

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

Assessment
Successfully create a functional programme/workflow and documentation.

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 Data Science and Scientific Workflows
2182741, SS 2026, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Cancelled

Content
The amount of data generated in scientific projects is increasing rapidly. The increase is partly due to the fact that new data-based evaluation methods allow a better and more precise analysis of scientific data. In addition, the linking of data provides new insights. This requires a systematic organization of data. The necessary knowledge of data science and computer science is equally required for both computer simulations and experimental investigations. The preparation/classification (e.g. electronic laboratory notebook) and structuring of data is a necessary step for their reuse. The lecture introduces the principles and software tools for the corresponding scientific workflows: Python and libraries, Jupyter notebook, shell scripts and documentation with git-tools. Applications in Python include statistical methods, machine learning techniques such as classification, artificial neural networks (ANN), convolutional neural networks (CNN), and Gaussian processes (GP) for simulation planning. Furthermore, an overview is given of database systems in materials research and the FAIR data principle (findability, accessibility, interoperability and reusability).

Objective:

Students will be able to

- organize and document data electronically
- handle data formats: simple, hierarchical ones
- deal with software management tools (git, gitlab)
- record scientific workflows in detail and ensure traceability
- use python-based libraries for data handling and analyses
- apply the fundamentals of machine learning

Detailed lecture content:

1. Introduction: the need for data science and computer science basics.
2. Programming and programming paradigms using Python
3. Software and data management: local and central management (git, gitlab)
4. Data processing: Automating tasks --- from scripts to workflow (examples from simulation and experiment)

5. Electronic lab book
6. Machine Learning: Classification, Neural Networks, Gaussian Process

Exercise:

The lecture material will be deepened in the exercises (exercise 1SWS).

Mode of examination:

- Project: Project topics from the areas
    - Material simulation and workflow
    - Data organization and analysis: from experiment or simulation
    - Presentation of the project in a 15 minute lecture + questions

- Preliminary examination performance: successful start to project work

Organizational issues
Die Vorlesung wurde ins Wintersemester verschoben.

Literature
Literatur:

- Handbuch Data Science, Hanser Verlag
- Effective Computation in Physics, Scopatz & Huff, O’Reilly 2015
- Python Data Science Handbook, J. VanderPlas, O’Reilly 2016.
- Materials Data Science, S. Sandfeld, Springer, 2024.

T 6.39 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-107559 - Computational Materials Science (20CP)
M-MACH-107562 - Structural Materials (20CP)
M-MACH-107575 - Computational Materials Science (40CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	76-T-MACH-105310	Design of Highly Stressed Components			Aktaa
ST 2026	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 6.40 Module component: Drive System Engineering A: Automotive Systems [T-MACH-113405]

Coordinators: Sascha Ott
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2146231	Drive System Engineering A: Automotive Systems	3 SWS	Lecture / Practice / 🗣	Ott, Düser
Exams					
WT 25/26	76-T-MACH-113405	Drive System Engineering A: Automotive Systems			Ott
ST 2026	76-T-MACH-113405	Drive System Engineering A: Automotive Systems			Ott, Düser

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

Assessment
written examination: 90 min duration

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 Drive System Engineering A: Automotive Systems

2146231, SS 2026, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Students acquire the basic skills needed to develop future energy-efficient and at the same time comfortably drivable powertrains. This includes holistic development methods and evaluations of powertrain systems. The main topics can be divided into the following chapters:

- Powertrain System
- Driver System
- Environment System
- System Components
- Development Process

Literature
Kirchner, E.; "Leistungsübertragung in Fahrzeuggetrieben: Grundlagen der Auslegung, Entwicklung und Validierung von Fahrzeuggetrieben und deren Komponenten", Springer Verlag Berlin Heidelberg 2007

Naunheimer, H.; "Fahrzeuggetriebe: Grundlagen, Auswahl, Auslegung und Konstruktion", Springer Verlag Berlin Heidelberg 2007

T 6.41 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration [T-FORUM-113580]

Coordinators: Dr. Christine Mielke
Christine Myglas
Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

In the Advanced Module, students can choose their own individual focus, e.g. sustainable development, data literacy, etc. The focus should be discussed with the module coordinator at the FORUM.

T 6.42 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration [T-FORUM-113582]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 6.43 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration [T-FORUM-113581]

Coordinators:	Dr. Christine Mielke Christine Myglas
Organisation:	General Studies. Forum Science and Society (FORUM)
Part of:	M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 6.44 Module component: Electromagnetics and Numerical Calculation of Fields [T-ETIT-100640]

Coordinators: Dr. Yongbo Deng
Prof. Dr. Ulrich Lemmer

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2141110	Electromagnetics and Numerical Calculation of Fields	2 SWS	Lecture / 🗣	Deng
WT 25/26	2141111	Exercise for 2308263 Electromagnetics and Numerical Calculation of Fields	1 SWS	Practice / 🗣	Deng
Exams					
WT 25/26	7308263	Electromagnetics and Numerical Calculation of Fields			Deng
ST 2026	7600003	Electromagnetics and Numerical Calculation of Fields			Deng

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

Assessment
Success control is carried out in the form of a written test of 120 minutes.

Prerequisites
none

Recommendations
Fundamentals of electromagnetic field theory.

T 6.45 Module component: Electron Microscopy I and II, with Exercises [T-PHYS-111915]

Coordinators: TT-Prof. Dr. Yolita Eggeler
Organisation: KIT Department of Physics
Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Oral examination	16 CP	graded	Irregular	1

Courses					
WT 25/26	4027011	Electron Microscopy I	2 SWS	Lecture / 🗣	Eggeler, Hettler
WT 25/26	4027012	Exercises to Electron Microscopy I	2 SWS	Practice / 🗣	Eggeler, Hettler
ST 2026	4027021	Electron Microscopy II	2 SWS	Lecture / 🗣	Eggeler, Hettler, Hettler, Müller
ST 2026	4027022	Exercises to Electron Microscopy II	2 SWS	Practice / 🗣	Eggeler

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

Assessment
Oral Exam, approx. 60 minutes.

Prerequisites
none

T 6.46 Module component: Electronic Properties of Solids I, without Exercises [T-PHYS-102578]

Coordinators:	Prof. Dr. Matthieu Le Tacon Prof. Dr. Wolfgang Wernsdorfer Prof. Dr. Wulf Wulfhekel
Organisation:	KIT Department of Physics
Part of:	M-MACH-107561 - Functional Materials (20CP) M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each winter term	1

Courses					
WT 25/26	4021011	Electronic Properties of Solids I	4 SWS	Lecture / 🗣	Le Tacon, Wernsdorfer

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

Prerequisites
none

T 6.47 Module component: Electronic Properties of Solids II, without Exercises [T-PHYS-104423]

Coordinators: Prof. Dr. Matthieu Le Tacon
Dr. Johannes Rotzinger
Prof. Dr. Alexey Ustinov
Prof. Dr. Wolfgang Wernsdorfer

Organisation: KIT Department of Physics

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	4021111	Electronic Properties of Solids II	2 SWS	Lecture / 🗣	Ustinov

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

Prerequisites
none

T 6.48 Module component: Emissions into the Environment [T-WIWI-114140]

Coordinators: Ute Karl
Organisation: KIT Department of Business and Economics
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	3 CP	pass/fail	Each winter term	1

Exams			
WT 25/26	7981962	Emissions into the Environment	Schultmann
ST 2026	7981962	Emissions into the Environment	Schultmann

Assessment
The assessment consists of an ungraded oral (30 minutes) or written exam (60 minutes).

Recommendations
None

Workload
90 hours

T 6.49 Module component: Energy and Environment [T-WIWI-114139]

Coordinators: Ute Karl
Organisation: KIT Department of Business and Economics
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	3 CP	pass/fail	Each summer term	1

Exams			
WT 25/26	7900302	Energy and Environment NEW	Karl
ST 2026	7900294	Energy and Environment NEW	Karl

Assessment
The assessment consists of an ungraded exam (60 minutes).

Prerequisites
None.

Workload
90 hours

T 6.50 Module component: Energy Efficient and Sustainable Tribological Systems [T-MACH-114016]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Assessment
oral exam, about 25 min

Prerequisites
Must not be used together with T-MACH-114015

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114015 - Energy Efficient and Sustainable Tribological Systems (in German) must not have been started.

Additional Information
The course is offered in English.

Workload
120 hours

T 6.51 Module component: Energy Efficient and Sustainable Tribological Systems (in German) [T-MACH-114015]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2182100	Energy Efficient and Sustainable Tribological Systems	2 SWS	Lecture / 🗣	Dienwiebel

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

Assessment
oral exam, about 25 min

Prerequisites
Must not be used together with T-MACH-114016

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114016 - Energy Efficient and Sustainable Tribological Systems 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 Energy Efficient and Sustainable Tribological Systems

2182100, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

Friction, lubrication, and wear significantly influence the energy efficiency and carbon footprint of machines and technical processes. The lecture will focus on new technologies for reducing friction that can drastically reduce energy losses caused by friction and wear. Regenerative and bio-based materials and lubricants will also be presented.

Topics

- Review of key tribology concepts
- In-depth study of fundamentals (surface interactions, tribochemistry)
- Low-friction systems: Superlubrication
    - Structural superlubrication
    - Liquid superlubrication
    - Applications
- Sustainable tribological systems
    - Substitution of critical substances
    - Biologically inspired solutions
    - Bio-based lubricants

Learning objectives

The student

- can describe basic tribochemical processes,
- is able to explain concepts and principles for achieving superlubricating systems in technology and nature,
- can name current approaches for substituting critical substances in tribological systems.

Further information

Basic knowledge of physics, chemistry, and materials science is required. Participation in the Tribology lecture is advantageous.

Attendance: 33.5 hours

Self-study: 116.5 hours

Success is assessed in the form of an approximately 30-minute oral exam (according to §4(2), 2 SPO).

T 6.52 Module component: Energy Efficient Intralogistic Systems [T-MACH-105151]

Coordinators: Dr.-Ing. Meike Kramer
Dr. Frank Schönung

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2117500	Energy efficient intralogistic systems	2 SWS	Lecture / 🗣	Kramer, Schönung
Exams					
WT 25/26	76-T-MACH-105151	Energy Efficient Intralogistic Systems			Kramer

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

Assessment
Oral, 30 min. examination dates after the end of each lesson period.

Prerequisites
none

Recommendations
The content of course “Basics of Technical Logistics I” (T-MACH-109919) should be known.

Additional Information
Visit the IFL homepage of the course for the course dates and/or possible limitations of course participation.

The course is offered in German

Workload
120 hours

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

V Energy efficient intralogistic systems

2117500, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The content of course “Basics of Technical Logistics” should be knownn.

Literature
Keine.

T 6.53 Module component: Energy Ethics [T-GEISTSOZ-115108]

Coordinators: Dr. Giovanni Frigo
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	5000005	Energy Ethics	2 SWS	Seminar	Frigo

Assessment
Academic achievements in the form of written assignments and/or oral performances.

Prerequisites
keine

Additional Information
The course is offered in English.

Workload
60 hours

T 6.54 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	76-T-MACH-109082	Engineering Materials for the Energy Transition			Seifert
ST 2026	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.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component 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 6.55 Module component: Engineering Materials for the Energy Transition [T-MACH-112691]

Coordinators: Prof. Dr. Hans Jürgen Seifert
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2193008	Engineering Materials for the Energy Transition	2 SWS	Lecture / 🗣	Seifert, Ziebert
Exams					
WT 25/26	76-T-MACH-112691	Engineering Materials for the Energy Transition			Seifert
ST 2026	76-T-MACH-112691	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-109082 – Materialien und Werkstoffe für die Energiewende must not have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-109082 - Engineering Materials for the Energy Transition must not have been started.

Recommendations
Knowledge of 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 Engineering Materials for the Energy Transition
2193008, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
oral examination (ca. 30 min)

Recommendations: Knowledge of Materials Science

Workload: 120 h

T 6.56 Module component: Environmental and Resource Policy [T-WIWI-114396]

Coordinators: Rainer Walz
Organisation: KIT Department of Business and Economics
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	2

Courses					
ST 2026	2560548	Environmental and Ressource Policy	2 SWS	Lecture / Practice	Walz

Assessment
Assessment is based on regular attendance of the course. This learning outcome is ungraded.

Prerequisites
None

Recommendations
It is recommended to already have knowledge in the area of industrial organization and economic policy. This knowledge may be acquired in the courses *Introduction to Industrial Organization* [2520371] and *Economic Policy* [2560280].

Workload
60 hours

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

V Environmental and Ressource Policy
2560548, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Literature
Weiterführende Literatur:

Michaelis, P.: Ökonomische Instrumente in der Umweltpolitik. Eine anwendungsorientierte Einführung, Heidelberg
OECD: Environmental Performance Review Germany, Paris

T 6.57 Module component: Exercices - Tribology [T-MACH-114854]

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

Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each winter term	1 semesters	1

Courses					
WT 25/26	2181114	Tribology	5 SWS	Lecture / Practice / 🗣	Dienwiebel, Scherge
Exams					
WT 25/26	76-T-MACH-114854	Exercices - Tribology (new, MACH, PO 2025)			Dienwiebel

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.

Workload
60 hours

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 6.58 Module component: Exercises for Applied Materials Simulation [T-MACH-110928]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-103712 - Simulation

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	2182616	Applied Materials Simulation	4 SWS	Lecture / Practice / 🗣	Gumbsch, Weygand
Exams					
ST 2026	76-T-MACH-110928	Exercises for Applied Materials Simulation			Gumbsch

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

Assessment
successful solving of all exercises

Prerequisites
T-MACH-107671 – Übungen zu Angewandte Werkstoffsimulation 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 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 Applied Materials Simulation

2182616, SS 2026, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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

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 6.59 Module component: Exercises for Applied Materials Simulation [T-MACH-107671]

Coordinators:	Prof. Dr. Peter Gumbsch Dr.-Ing. Johannes Schneider Dr. Daniel Weygand
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-103712 - Simulation

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	3

Courses					
ST 2026	2182614	Applied Materials Simulation	4 SWS	Lecture / Practice /	Gumbsch, Weygand
Exams					
ST 2026	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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110928 - Exercises for Applied Materials Simulation 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 Applied Materials Simulation

2182614, SS 2026, 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 6.60 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-107325 - Properties

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
Exams					
WT 25/26	76-T-MACH-114408	Exercises for Microstructure-Property-Relationships			Kirchlechner, Gruber, Wagner

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114407 - Exercises for Microstructure-Property-Relationships (in German) 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 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 6.61 Module component: Exercises for Microstructure-Property-Relationships (in German) [T-MACH-114407]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107325 - Properties

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	2178125	Exercices in Microstructure-Property-Relationships	1 SWS	Practice /	Kirchlechner, Wagner, Gruber
Exams					
ST 2026	76-T-MACH-114407	Exercises for Microstructure-Property-Relationships (in German)			Kirchlechner, Gruber, Wagner

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

Assessment
Successful participation in a final colloquium

Prerequisites
T-MACH-114408 – Exercises for Microstructure-Property-Relationships 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 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 Exercices in Microstructure-Property-Relationships

2178125, SS 2026, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
Exercise course for the lecture Microstructure-Property-Relationships LV Nr. 2178124.

T 6.62 Module component: Exercises for Thermodynamic and Kinetic Fundamentals of Material Science [T-MACH-114535]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107324 - Thermodynamics and Kinetics

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	2194731	Exercises for Thermodynamic and Kinetic Fundamentals of Material Science	1 SWS	Practice / 🗣	Gorr, Seifert

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

Prerequisites
T-MACH-114534 – Übungen zu Thermodynamischen und Kinetischen Grundlagen der Materialwissenschaft has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114534 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.

Additional Information
The course is offered in English.

Workload
60 hours

T 6.63 Module component: Exercises for Thermodynamic and Kinetic Fundamentals of Material Science [T-MACH-114534]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107324 - Thermodynamics and Kinetics

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2193021	Exercises for Thermodynamic and Kinetic Fundamentals of Material Science	1 SWS	Practice / 🗣	Gorr, Seifert
Exams					
WT 25/26	76-T-MACH-114534	Exercises for Thermodynamic and Kinetic Fundamentals of Material Science			Gorr, Seifert

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

Prerequisites
T-MACH-114535 – Exercises for Thermodynamic and Kinetic Fundamentals of Material Science has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114535 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.

Additional Information
The course is offered in German.

Workload
60 hours

T 6.64 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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 aufgrund der hohen Nachfrage nun in vier Gruppen statt:

Gruppe 1: 16.2.26 bis 18.2.26 Gruppe 2: 18.2.26 bis 20.2.26

Gruppe 3: 23.2.26 bis 25.2.26 Gruppe 4: 25.2.26 bis 27.2.26

Der Tag beginnt jeweils um 8 Uhr und endet um 16 Uhr bzw. freitags um 15 Uhr. Mittwochs um 13 Uhr findet der Gruppenwechsel statt.

Die Gruppeneinteilung erfolgt über selbstständigen Beitritt in eine der vier Gruppen.

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 6.65 Module component: Fabrication and Characterisation of Optoelectronic Devices [T-ETIT-103613]

Coordinators: Prof. Dr. Ulrich Wilhelm Paetzold
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2313760	Fabrication and Characterization of Optoelectronic Devices	2 SWS	Lecture / 🗣	Paetzold
Exams					
WT 25/26	7313760	Fabrication and Characterisation of Optoelectronic Devices			Paetzold
ST 2026	7313760	Fabrication and Characterisation of Optoelectronic Devices			Paetzold

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

Prerequisites
none

T 6.66 Module component: Fabrication Processes in Microsystem Technology [T-MACH-102166]

Coordinators: Dr. Klaus Bade
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture / Blended	Bade
Exams					
WT 25/26	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, 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 6.67 Module component: Failure Analysis [T-MACH-114610]

Coordinators: Jun.-Prof. Dr. Jens Bauer
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2182102	Failure Analysis	2 SWS	Lecture / 🗣	Bauer

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

Assessment
oral exam approx. 30 minutes

Prerequisites
The course T--MACH-105724 - Failure Analysis must not have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105724 - Failure Analysis (in German) 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 English.

The course will be offered for the first time in the summer semester of 2026!

Workload
120 hours

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

V Failure Analysis

2182102, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
1)Objective, procedure and content of a damage analysis
2) Destructive and non-destructive examination methods
3)Types of failure

- Failure due to mechanical loads
- Failure due to corrosion in electrolytes
- Failure due to thermal loads
- Failure due to tribological loads

4) Basic principles of failure analysis

- Stress during operation versus material resistance

- Stress hypothesis

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

- J.L. Otegui: Failure Analysis. Springer, 2014, ISBN 9783319039107
- T.D. Burleigh: Failure Analysis of Materials: An Introduction. lulu.com, 2018, ISBN 9781387457205
- K.P. Balan: Metallurgical Failure Analysis. Elsevier, 2018, ISBN 9780128143360
- H.M. Tawancy, A. Ul-Hamid, N.M. Abbas: Practical Engineering Failure Analysis. CRC Press, 2004, ISBN 9780203026298
- S.-I. Nishida: Failure Analysis in Engineering Applications. Butterworth-Heinemann Ltd., 2014, ISBN 9781483193779
- H.-C. Qua et al.: Applied Engineering Failure Analysis. CRC Press, 2015, ISBN 9781482222197

T 6.68 Module component: Failure Analysis (in German) [T-MACH-105724]

Coordinators: Prof. Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	76-T-MACH-105724	Failure Analysis			Schneider, Greiner

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.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component 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 6.69 Module component: Fatigue of Materials [T-MACH-112106]

Coordinators: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2173586	Fatigue of Materials	2 SWS	Lecture / 🗣	Guth
Exams					
WT 25/26	76-T-MACH-112106	Fatigue of Materials			Guth
ST 2026	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 2026, 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 6.70 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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					
WT 25/26	76-T-MACH-105324	Foundations of Nonlinear Continuum Mechanics			Kamlah
ST 2026	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 6.71 Module component: Foundations of Technology Ethics [T-GEISTSOZ-115075]

Coordinators: Dr. phil. Simon Derpmann
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	5000010	Introduction to the Ethics of Technology and Responsible Engineering	2 SWS	Course	Derpmann
Exams					
ST 2026	7400580	Foundations of Technology Ethics			Derpmann

Assessment
The course is assed through a written in-person exam lasting 60 minutes.

Prerequisites
T-ETIT-111923 – Technikethik - ARs ReflecTIonis must not have been started.

Additional Information
The course is offered in English.

Learning objectives: Engineering decisions shape lives, institutions, and ecosystems—yet they are rarely value-neutral. This course trains students to identify and critically analyze the ethical dimensions of technological systems, reconstruct and evaluate moral arguments, and navigate value conflicts in engineering practice. Through structured debates, they develop the capacity to justify coherent positions and articulate the responsibilities of engineers, firms, and institutions toward society.

Upon completion students are prepared to critically engage with ethical and political challenges in technology—in professional practice, public discourse, and their own role in shaping a responsible technological future.

Workload
60 hours

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

V Introduction to the Ethics of Technology and Responsible Engineering
Course (Ku)
5000010, SS 2026, 2 SWS, Language: English, Open in study portal

Content
Engineers do not only solve technical problems; they design and implement systems that shape society. Decisions made during the development of technologies — including robotics, autonomous systems, industrial automation, AI-driven control systems, and energy or production technologies — often carry significant ethical and societal consequences. Understanding these consequences is essential for responsible engineering practice.

This course provides a structured introduction to the foundations of ethical reasoning and their application in technological contexts. Students are introduced to core normative concepts, including responsibility, harm, justice, autonomy, rights, and sustainability, as well as key approaches in ethical theory. The course emphasizes how ethical arguments are constructed, how normative claims can be justified, and how value conflicts can be analyzed systematically in engineering practice.

Through selected case studies and examples from contemporary technology, students explore ethical challenges such as safety and risk, automation and AI, human–machine interaction, environmental sustainability, and the embedding of societal values in technical systems. The course combines short lectures, structured discussions, and guided analysis of practical cases, providing students with opportunities to formulate, defend, and critically evaluate ethical positions.

The primary goal is to equip students with both the conceptual tools and reflective skills needed to integrate ethical considerations into technical decision-making, enabling them to navigate complex moral challenges in professional engineering contexts.

Literature
Ibo van de Poel & Lamber Royakkers: *Ethics, Technology, and Engineering: An Introduction.* John Wiley & Sons, 2023.

Sven Nyholm. *This is Technology Ethics: An Introduction.* John Wiley & Sons, 2023

T 6.72 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174575	Foundry Technology	2 SWS	Lecture / 🖥	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 2026, 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 6.73 Module component: Fracture and Damage Mechanics [T-BGU-100087]

Coordinators: Prof. Dr.-Ing. Thomas Seelig
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	6215903	Fracture and Damage Mechanics	2 SWS	Lecture / 🗣	Seelig
WT 25/26	6215904	Exercises Fracture and Damage Mechanics	2 SWS	Practice / 🗣	Seelig
Exams					
WT 25/26	8243100087	Fracture and Damage Mechanics			Seelig

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 6.74 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines			Kehrwald
ST 2026	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 6.75 Module component: Functional Ceramics [T-MACH-114752]

Coordinators: Prof. Dr. Kaline Pagnan Furlan
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	4 CP	graded	Each term	1 semesters	2

Courses					
WT 25/26	2125740	Functional Ceramics (EN)	2 SWS	Lecture / Blended	Pagnan Furlan
ST 2026	2125740	Functional Ceramics (EN)	2 SWS	Lecture / Blended	Pagnan Furlan
Exams					
WT 25/26	76-T-MACH-114752	Functional Ceramics			Pagnan Furlan

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

Assessment
Examination of another type (*Prüfungsleistung anderer Art*). Presentation and report on scientific topics related to functional ceramics, based on previous Research-Oriented Teaching sessions (90 minutes at least) involving detailed literature search, review and interpretation (Research-Oriented Teaching method related to Research-based Learning: identification of topics, documentation and evaluation of the results, and presentation of the results). Presentation session has approximately 20 minutes followed by scientific discussion via question and answers session with approximately 10 min.

Prerequisites
T-MACH-105179 – Funktionskeramiken must not be started yet.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105179 - Functional Ceramics 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 Functional Ceramics (EN)
2125740, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content
This course introduces the design, fabrication, and characterization of functional ceramics for advanced technological applications. Students explore how tailored processing routes and microstructural control enable specific electrical, thermal, and mechanical functions. Through research-based learning, they gain insight into key applications such as energy conversion, sensing, catalysis, and biomedical uses, linking scientific principles to real-world material innovations.

Organizational issues
Notice: the course starts on 04.11.2025!

Literature
1. Richerson David W, The magic of ceramics. Hoboken, N.J: Wiley. 2012. https://ebookcentral.proquest.com/lib/karlsruhetech/detail.action?docID=4034782 *

2. Richerson David W, . Modern ceramic engineering. Boca Raton, FL: CRC Press. 2018. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&db=nlabk&AN=1802218 *

3. Research papers and patents

* Access possible via KIT Network.

V	**Functional Ceramics (EN)** 2125740, SS 2026, 2 SWS, Language: English, Open in study portal	**Lecture (V)** **Blended (On-Site/Online)**

Content
This course introduces the design, fabrication, and characterization of functional ceramics for advanced technological applications. Students explore how tailored processing routes and microstructural control enable specific electrical, thermal, and mechanical functions. Through research-based learning, they gain insight into key applications such as energy conversion, sensing, catalysis, and biomedical uses, linking scientific principles to real-world material innovations.

Literature
1. Richerson David W, The magic of ceramics. Hoboken, N.J: Wiley. 2012. https://ebookcentral.proquest.com/lib/karlsruhetech/detail.action?docID=4034782 *

2. Richerson David W, . Modern ceramic engineering. Boca Raton, FL: CRC Press. 2018. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&db=nlabk&AN=1802218 *

3. Research papers and patents

* Access possible via KIT Network.

T 6.76 Module component: Functional Ceramics [T-MACH-105179]

Coordinators: Dr. Miriam Botros
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	76-T-MACH-105179	Functional Ceramics			Botros
ST 2026	76-T-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
T-MACH-114752 – Functional Ceramics must not be started yet.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114752 - Functional Ceramics must not have been started.

Additional Information
The course is offered in German.

Workload
120 hours

T 6.77 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-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	see Annotations	2

Courses					
WT 25/26	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture / 🗣	Weber
ST 2026	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture / 🗣	Weber
Exams					
WT 25/26	76-T-MACH-111389	Fundamentals in the Development of Commercial Vehicles			Weber
ST 2026	76-T-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 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/PasswoerterIlias/

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.

V **Fundamentals in the Development of Commercial Vehicles II**
2114844, SS 2026, 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
die Vorlesung findet an unregelmäßigen Terminen am Campus Ost statt. 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

T 6.78 Module component: Fundamentals of Combustion I [T-MACH-114043]

Coordinators: Prof. Dr. Dr. Michael Fischlschweiger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	3165016	Fundamentals of Combustion I	2 SWS	Lecture /	Shrotriya
WT 25/26	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice /	Shrotriya
Exams					
WT 25/26	76-T-MACH-114043	Fundamentals of Combustion I			Bykov
ST 2026	76-T-MACH-114043	Fundamentals of Combustion I			Bykov

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

Assessment
Written exam, approx. 3 hours

Prerequisites
T-MACH-105213 and T-MACH-113998 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105213 - Fundamentals of Combustion I (in German) 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 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 6.79 Module component: Fundamentals of Combustion I (in German) [T-MACH-105213]

Coordinators: Prof. Dr. Dr. Michael Fischlschweiger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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 / 🗣	Yu
WT 25/26	2165517	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Yu
WT 25/26	3165016	Fundamentals of Combustion I	2 SWS	Lecture / 🗣	Shrotriya
WT 25/26	3165017	Fundamentals of Combustion I (Tutorial)	1 SWS	Practice / 🗣	Shrotriya
Exams					
WT 25/26	76-T-MACH-105213	Fundamentals of Combustion I			Bykov
WT 25/26	76-T-MACH-105213 - english	Fundamentals of Combustion I			Bykov
ST 2026	76-T-MACH-105213	Fundamentals of Combustion I			Bykov
ST 2026	76-T-MACH-105213 - english	Fundamentals of Combustion I			Bykov

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114043 - Fundamentals of Combustion I 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 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 6.80 Module component: Fundamentals of Combustion II [T-MACH-114044]

Coordinators: Dr. Viatcheslav Bykov
Prof. Dr. Dr. Michael Fischlschweiger

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	3166550	Fundamentals of Combustion II	2 SWS	Lecture / 🗣	Yu
ST 2026	3166551	Fundamentals of Combustion II (Exercises)	2 SWS	Practice / 🗣	Yu
Exams					
WT 25/26	76-T-MACH-114044	Fundamentals of Combustion II			Bykov
ST 2026	76-T-MACH-114044	Fundamentals of Combustion II			Bykov

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

Assessment
oral exam

Prerequisites
T-MACH-105325 and T-MACH-113998 must not be started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-105325 - Fundamentals of Combustion II (in German) 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 Fundamentals of Combustion II

3166550, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Three dimensional Navier-Stokes equations for reacting flows
- Turbulent reactive flows
- Turbulent non-premixed flames
- Turbulent premixed flames
- Combustion of liquid and solid fuels
- Engine knock
- Thermodynamics of combustion processes
- Transport phenomena
- Effects of Combustion Processes on the Atmosphere

Organizational issues
Nachteilsausgleiche bitte fristgerecht an den Dozenten schicken.
Please send the requests for compensations for disadvantages to the lecturer within the deadline

Literature
Vorlesungsskript;

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch; Heidelberg, Karlsruhe, Berkley 2006

V **Fundamentals of Combustion II (Exercises)**
3166551, SS 2026, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Calculation and Simulation of combustion processes

Organizational issues
Nachteilsausgleiche bitte fristgerecht an den Dozenten schicken.
Please send the requests for compensations for disadvantages to the lecturer within the deadline

Literature
Skript Grundlagen der technischen Verbrennung (I+II) von Prof. Dr. rer. nat. habil. U. Maas
Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 6.81 Module component: Fundamentals of Combustion II (in German) [T-MACH-105325]

Coordinators: Dr. Viatcheslav Bykov
Prof. Dr. Dr. Michael Fischlschweiger

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2166538	Fundamentals of combustion II	2 SWS	Lecture / 🗣	Yu, Bykov
ST 2026	2166539	Übung zu Grundlagen der technischen Verbrennung II	2 SWS	Practice / 🗣	Bykov
Exams					
WT 25/26	76-T-MACH-105325	Fundamentals of Combustion II			Bykov
ST 2026	76-T-MACH-105325	Fundamentals of Combustion II			Bykov

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

Assessment
Oral exam, approx. 20 min

Prerequisites
T-MACH-114044 and T-MACH-113998 must not have started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114044 - Fundamentals of Combustion 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 Fundamentals of combustion II

2166538, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Three dimensional Navier-Stokes equations for reacting flows
- Turbulent reactive flows
- Turbulent non-premixed flames
- Turbulent premixed flames
- Combustion of liquid and solid fuels
- Engine knock
- Thermodynamics of combustion processes
- Transport phenomena
- Effects of Combustion Processes on the Atmosphere

Organizational issues
Nachteilsausgleiche bitte fristgerecht an den Dozenten schicken.
Please send the requests for compensations for disadvantages to the lecturer within the deadline

Literature
Vorlesungsskript;

Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch; Heidelberg, Karlsruhe, Berkley 2006

V **Übung zu Grundlagen der technischen Verbrennung II**
2166539, SS 2026, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Calculation and Simulation of combustion processes

Organizational issues
Nachteilsausgleiche bitte fristgerecht an den Dozenten schicken.
Please send the requests for compensations for disadvantages to the lecturer within the deadline.

Literature
Skript Grundlagen der technischen Verbrennung (I+II) von Prof. Dr. rer. nat. habil. U. Maas
Buch Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 6.82 Module component: Fundamentals of Optics and Photonics [T-PHYS-103628]

Coordinators: Prof. Dr. David Hunger
Prof. Dr. Moritz Kreysing
Prof. Dr. Ulrich Lemmer

Organisation: KIT Department of Physics

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	4044021	KSOP - Fundamentals of Optics & Photonics	4 SWS	Lecture / 🗣	Kreysing, Lemmer
WT 25/26	4044022	KSOP - Exercises to Fundamentals of Optics & Photonics	2 SWS	Practice / 🗣	Unni Chorakkunnath, Hunger, Kreysing
Exams					
WT 25/26	7800046	Fundamentals of Optics and Photonics - Exam 2			Hunger, Lemmer, Kreysing
WT 25/26	7800058	Fundamentals of Optics and Photonics - Exam 1			Hunger, Lemmer, Kreysing

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

Prerequisites
Successfull participation in the exercises

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-PHYS-103630 - Fundamentals of Optics and Photonics - Unit must have been passed.

T 6.83 Module component: Fundamentals of Optics and Photonics - Unit [T-PHYS-103630]

Coordinators: Prof. Dr. David Hunger
Prof. Dr. Moritz Kreysing
Prof. Dr. Ulrich Lemmer

Organisation: KIT Department of Physics

Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

Courses					
WT 25/26	4044021	KSOP - Fundamentals of Optics & Photonics	4 SWS	Lecture / 🗣	Kreysing, Lemmer
WT 25/26	4044022	KSOP - Exercises to Fundamentals of Optics & Photonics	2 SWS	Practice / 🗣	Unni Chorakkunnath, Hunger, Kreysing
Exams					
WT 25/26	7800057	Fundamentals of Optics & Photonics - Exercises			Hunger, Kreysing, Lemmer

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

Prerequisites
none

T 6.84 Module component: Fundamentals of Phase-Field Modelling [T-MACH-114627]

Coordinators: Dr.-Ing. Daniel Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2182310	Fundamentals of Phase-Field Modelling	3 SWS	Lecture / Practice / 🗣	Schneider
Exams					
WT 25/26	76-T-MACH-114627	Fundamentals of Phase-Field Modelling			Schneider

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

Assessment
Oral exam about 25 minutes.

Prerequisites
none

Recommendations
The course is offered in German.

Workload
120 hours

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

V Fundamentals of Phase-Field Modelling

2182310, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
Numerical methods based on the phase field method have become an indispensable and extremely versatile tool in materials science and physics. The method generally operates on the mesoscopic length scale and provides important information on morphological changes in materials by mapping interfacial movements of physically separated regions. Diffuse interfacial parameterisation allows the temporal and spatial evolution of an arbitrarily complex multiphase, multicomponent and polycrystalline microstructure in materials to be modelled without the need to make additional assumptions about shape or mutual distribution. An outstanding feature of the methodology is the ability to take into account different physical driving forces for interfacial motion such as diffusive, electrochemical, mechanical, etc. influences can be taken into account. Furthermore, large-scale numerical simulations can be realised by numerically solving the coupled multi-physics differential equations on high-performance computers. These outstanding properties make the phase field method extremely versatile. It is used as a numerical method for modelling a variety of microstructural processes. Various phase field models have been developed in the different research communities with the integration of different physical quantities such as continuum mechanics, fluid mechanics, electrochemistry, magnetism etc. based on Ginzburg-Landau theory or on Griffith's criterion, models based on Cahn-Hillard, Landau-Lifschits-Gilbert, Landau-Ginsburg-Devonshire theory. The course begins with an introduction to the basics of phase field modelling. In the practical part, the essential components of the phase field method are illustrated by means of exercises. The results are analysed by means of visualisations, whereby the influence of parameters such as mobilities and interfacial energies on the interfacial motion is investigated. Furthermore, the lecture gives an overview of the different approaches of the phase field method. A central aspect of the lecture is the integration of driving forces into the models. Overall, the lecture provides a comprehensive understanding of the phase field method and its applications in modern materials science.

T 6.85 Module component: Fundamentals on Plasma Technology [T-ETIT-100770]

Coordinators: Dr.-Ing. Rainer Kling
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Exams			
WT 25/26	7313734	Fundamentals on Plasma Technology	Kling, Trampert

Assessment
Success control takes place in form of an overall oral examination (approx. 20 minutes).

Prerequisites
none

Recommendations
Knowledge from "ETIT-100481 - Plasmastrahlungsquellen" is helpful.

T 6.86 Module component: Genetics [T-CIWVT-111063]

Coordinators: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Written examination	2 CP	graded	Each winter term	1

Courses					
WT 25/26	2212111	Biology for Engineers - Genetics	2 SWS	Lecture / 🗣	Neumann
Exams					
WT 25/26	7212111-V-GEN	Genetics			Holtmann
ST 2026	7212111-V-GEN	Genetics			Neumann

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

Assessment
Written examination with a duration of 90 minutes (section 4 subsection 2 No. 1 SPO).

Prerequisites
None

T 6.87 Module component: High Performance Computing [T-MACH-105398]

Coordinators: Prof. Dr. Britta Nestler
Dr. Martin Reder
Dr.-Ing. Michael Selzer
Marcel Weichel

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2183721	High Performance Computing	3 SWS	Lecture / Practice / ✕	Nestler, Selzer
ST 2026	2183721	High Performance Computing	3 SWS	Lecture / Practice / 🗣	Nestler

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

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
120 hours

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

V High Performance Computing

2183721, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
Cancelled

Content
This course provides students with a practice-oriented and solid introduction to the field of High Performance Computing (HPC). The focus lies on the efficient handling of large
data sets as well as on the application of complex simulations and computationally intensive models on modern high-performance computing systems. The course introduces the hardware and software architectures of HPC ecosystems and discusses typical challenges and solution strategies for problems that can be addressed using HPC. These concepts are illustrated through concrete application examples, with a particular emphasis on microstructure and materials simulations. Building on this foundation, various programming models for parallel computing are covered, including thread-based parallelization using pthreads and OpenMP, as well as parallel computations on distributed systems using the Message Passing Interface (MPI). In an accompanying computer lab, students apply the course content in practice. They develop parallel programs, analyze their performance, and optimize them step by step. Short exercises, mini-projects, and structured experiments are combined to foster a practical understanding of parallelization and performance optimization.

Contents

- Thread-based parallelization using pthreads and OpenMP
- Parallel computations on distributed systems using the Message Passing Interface (MPI)
- Examples of parallelization applied to numerical simulations
- SIMD vectorization
- Introduction to working on HPC clusters, e.g. job schedulers
- Practical application of the course content in an accompanying computer lab

Organizational issues
Dieser Kurs findet nur im Sommersemester statt.

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007

V

High Performance Computing

2183721, SS 2026, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
This course provides students with a practice-oriented and solid introduction to the field of High Performance Computing (HPC). The focus lies on the efficient handling of large
data sets as well as on the application of complex simulations and computationally intensive models on modern high-performance computing systems. The course introduces the hardware and software architectures of HPC ecosystems and discusses typical challenges and solution strategies for problems that can be addressed using HPC. These concepts are illustrated through concrete application examples, with a particular emphasis on microstructure and materials simulations. Building on this foundation, various programming models for parallel computing are covered, including thread-based parallelization using pthreads and OpenMP, as well as parallel computations on distributed systems using the Message Passing Interface (MPI). In an accompanying computer lab, students apply the course content in practice. They develop parallel programs, analyze their performance, and optimize them step by step. Short exercises, mini-projects, and structured experiments are combined to foster a practical understanding of parallelization and performance optimization.
Contents
- Thread-based parallelization using pthreads and OpenMP
- Parallel computations on distributed systems using the Message Passing Interface (MPI)
- Examples of parallelization applied to numerical simulations
- SIMD vectorization
- Introduction to working on HPC clusters, e.g. job schedulers
- Practical application of the course content in an accompanying computer lab

Organizational issues
Nur im Sommersemester

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007

T 6.88 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2126749	Advanced powder metals	2 SWS	Lecture /	Schell
Exams					
WT 25/26	76-T-MACH-102157	High Performance Powder Metallurgy Materials			Schell
ST 2026	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 2026, 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 6.89 Module component: High Temperature Corrosion [T-MACH-113598]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2193055	High Temperature Corrosion	2 SWS	Lecture / 🗣	Gorr
Exams					
WT 25/26	76-T-MACH-113598	High Temperature Corrosion			Gorr
ST 2026	76-T-MACH-113598	High Temperature Corrosion			Gorr

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

Assessment
oral exam (about 30 minutes)

Prerequisites
none

Recommendations
Knowledge from the basic materials science 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 High Temperature Corrosion

Lecture (V)
On-Site

2193055, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
Oral examination (about 30 min)

Teaching content:

- High temperature functional and structural materials
- Thermodynamic fundamentals
- Kinetics and oxidation rate laws
- Defects in oxides
- Carl Wagner oxidation theory
- Oxidation of alloys
- Internal corrosion
- Protective coatings

Qualification targets:

The students gain fundamental understanding about underlying oxidation mechanisms of pure metals and complex alloys and acquire knowledge about ways to intrinsically protect high temperature materials by changing their chemical composition or/and atmospheric conditions as well as by applying protective coatings.

Recommendations:

Basic course in materials science and engineering and the course *Introduction to high temperature materials* (Gorr)

Organizational issues
Anmeldung verbindlich bis zum 20.10.2025 unter sabine.deubig@kit.edu und bronislava.gorr@kit.edu

Literature

- Birks, N., Meier, G.H. and Pettit, F.S., Introduction to the High Temperature Oxidaiton of Metals, Cambridge University Press, (Cambridge, 2006)
- Kofstad, P., High Temperature Corrosion, Elsevier Applied Science, (London, 1988)

T 6.90 Module component: High Temperature Materials [T-MACH-105459]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174605	High Temperature Materials	2 SWS	Lecture / 🗣	Heilmaier
Exams					
WT 25/26	76-T-MACH-105459	High Temperature Materials			Heilmaier
ST 2026	76-T-MACH-105459	High Temperature Materials			Heilmaier

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

Assessment
Oral exam, about 25 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 High Temperature Materials

2174605, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

learning objectives:

Students are able to

- Define properly the term "high temperature" with respect to materials
- Describe the shape of the creep curve based on underlying deformation mechanisms
- Rationalize the influence of relevant parameters such as temperature, stress, microstructure on the high temperature deformation behavior
- Develop strategies for improving creep resistance of alloys via modifying their composition
- Select properly industrially relevant high temperature structural materials for various applications

Literature

B. Ilschner, Hochtemperaturplastizität, Springer-Verlag, Berlin

M.E. Kassner, Fundamentals of Creep in Metals and Alloys, Elsevier, Amsterdam, 2009

T 6.91 Module component: History of Technology and the Environment for Mechanical Engineering Students [T-GEISTSOZ-115018]

Coordinators: Prof. Dr. Marcus Popplow
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-106939 - Technology and Society

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

Courses					
ST 2026	5012069	History of Technology and the Environment for Mechanical Engineering Students	2 SWS	Seminar / 🗣	Popplow

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

Assessment
Mandatory for obtaining 4 CP are a) the weekly submission of short, informal comments on the topics to be worked on and b) in a meeting, usually in pairs, a short oral summary of the submissions and the leading of the corresponding discussion.

Prerequisites
none

Workload
120 hours

T 6.92 Module component: History of Technology and the Environment for Mechanical Engineering Students [T-GEISTSOZ-113951]

Coordinators: Prof. Dr. Marcus Popplow
Organisation: KIT Department of Humanities and Social Sciences
Part of: M-MACH-106939 - Technology and Society

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

Courses					
WT 25/26	5012045	History of Technology and the Environment for Mechanical Engineering Students	2 SWS	Seminar / 🗣	Popplow
ST 2026	5012014	Science and Technology in 20th Century Wars	2 SWS	Seminar / 🗣	Schauz
WT 26/27	5012045	History of Technology and the Environment for Mechanical Engineering Students	2 SWS	Seminar / 🗣	Popplow
Exams					
WT 25/26	7400530	History of Technology and the Environment for Mechanical Engineering Students			Popplow
ST 2026	7400565	History of Technology and the Environment for Mechanical Engineering Students (in English)			Popplow

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

Assessment
Mandatory for obtaining 4 CP are a) the weekly submission of short, informal comments on the topics to be worked on and b) in a meeting, usually in pairs, a short oral summary of the submissions and the leading of the corresponding discussion.

Prerequisites
none

Workload
120 hours

T 6.93 Module component: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [T-INFO-101262]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Hon.-Prof. Dr. Uwe Spetzger
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	2

Courses					
WT 25/26	2424139	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
ST 2026	24678	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
Exams					
WT 25/26	7500118	Human Brain and Central Nervous System: Snatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger
ST 2026	7500145	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger

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

Assessment
Success is assessed in the form of a written examination (usually lasting 45 minutes) in accordance with Section 4 (2) No. 1 SPO.

Prerequisites
None.

Recommendations
Attending the internships and seminars in the field of medical technology at the institute is recommended, as initial practical and theoretical experience in the many different areas is imparted and deepened.

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

V Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy

Lecture (V)
On-Site

24678, SS 2026, 2 SWS, Language: German, Open in study portal

Content
The course provides an overview of modern neuro-medicine and provides a basic understanding of neuroanatomy, sensory and neurophysiology, which represents an important interface to the innovative research areas of neuroprosthetics (optical, acoustic prostheses). There is also a close connection to motor systems in robotics. There are further links to the fields of imaging and image processing and intraoperative support systems. Practical relevance is established and specific application examples in medical diagnostics and therapy are presented.

Goals:

After successfully completing the course, students will have a basic understanding and basic information about the structure and complex functioning of the brain and the central nervous system (CNS). They will learn the basics of neurophysiology and sensory functions and, in particular, the technically complex modern diagnostics of the brain and CNS. In addition, students learn the basics of modern treatment modalities for various neurological and neurosurgical diseases and are able to understand the application and use of different medical equipment and devices. The overview of modern neuro-medicine allows interdisciplinary recognition and analysis of problems and allows the implementation of theoretical models in a concrete practical context.

T 6.94 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-107326 - MINT Elective Module

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
ST 2026	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
Schedule change:

The first lecture has been postponed by one week to November 5, 2025.

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 6.95 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-107326 - MINT Elective Module

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
ST 2026	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 6.96 Module component: Human-Machine-Interaction in Anthropomatics: Basics [T-INFO-114132]

Coordinators: Prof. Dr.-Ing. Jürgen Beyerer
Dr.-Ing. Florian van de Camp

Organisation: KIT Department of Informatics

Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework (written)	4 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	2424100	Human-Machine-Interaction in Anthropomatics: Basics	2 SWS	Lecture /	van de Camp
Exams					
WT 25/26	7500017	Human-Machine-Interaction in Anthropomatics: Basics			Beyerer, van de Camp

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

Assessment
Success is assessed in the form of coursework in accordance with Section 4 (3) SPO.

Prerequisites
None.

Workload
120 hours

T 6.97 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-107326 - MINT Elective Module

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					
WT 25/26	7306321	Hybrid and Electric Vehicles			Doppelbauer
ST 2026	7306321	Hybrid and Electric Vehicles			Doppelbauer

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

Assessment
Success is assessed in the form of a written examination lasting 120 minutes.

Prerequisites
none

Recommendations
To understand the module, basic knowledge of electrical engineering is recommended (acquired, for example, by attending the modules "Elektrische Energietechnik", "Electrical Elektrotechnik für Wirtschaftsingenieure I+II" or "Elektrotechnik und Elektronik für Maschinenbauingenieure").

T 6.98 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Exams			
WT 25/26	7100039	Hydrogen as Energy Carrier	Ehrenberg

Assessment
Oral exam, about 25 minutes

Workload
120 hours

T 6.99 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	4 CP	pass/fail	Each summer term	1 semesters	4

Courses					
ST 2026	2173584	Hydrogen in Materials – Exercises and Lab Course	2 SWS	Practice / ⚙	Wagner
Exams					
ST 2026	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.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112942 - Hydrogen in Materials – Exercises and Lab Course (in German) must not have been 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 2026, 2 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

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 6.100 Module component: Hydrogen in Materials – Exercises and Lab Course (in German) [T-MACH-112942]

Coordinators: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	4 CP	pass/fail	Each winter term	1 semesters	2

Courses					
WT 25/26	2174573	Hydrogen in Materials – Exercises and Lab Course	2 SWS	Practice / 🗣	Wagner, Pundt
Exams					
WT 25/26	76-T-MACH-112942	Hydrogen in Materials – Exercises and Lab Course			Wagner
ST 2026	76-T-MACH-112942	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-112159 must not be started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-112159 - Hydrogen in Materials – Exercises and Lab Course must not have been started.

Recommendations
Participation is only possible parallel to the lecture.

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 in Materials – Exercises and Lab Course

2174573, WS 25/26, 2 SWS, Language: German, 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.

T 6.101 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2173588	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement	2 SWS	Lecture / 🗣	Pundt, Wagner
Exams					
WT 25/26	76-T-MACH-110923	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt
ST 2026	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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110957 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (in German) 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 Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement

Lecture (V)
On-Site

2173588, SS 2026, 2 SWS, Language: English, Open in study portal

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 6.102 Module component: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (in German) [T-MACH-110957]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2174572	Hydrogen in Materials: from energy storage to hydrogen embrittlement	2 SWS	Lecture / 🗣	Pundt, Wagner
Exams					
WT 25/26	76-T-MACH-110957	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement			Pundt
ST 2026	76-T-MACH-110957	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-110923 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement has not been started

T-MACH-108853 - Wasserstoff in Materialien has not been started

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-110923 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement 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 Hydrogen in Materials: from energy storage to hydrogen embrittlement

Lecture (V)
On-Site

2174572, WS 25/26, 2 SWS, Language: German, Open in study portal

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 6.103 Module component: Integrated Photonics [T-ETIT-114418]

Coordinators: Prof. Dr.-Ing. Christian Koos
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Version
Oral examination	6 CP	graded	1

Courses					
WT 25/26	2309440	Integrated Photonics	2 SWS	Lecture / 🗣	Koos, N.N.
WT 25/26	2309441	Tutorial to Integrated Photonics	2 SWS	Practice / 🗣	Koos, N.N., Khairy
Exams					
WT 25/26	7300021	Integrated Photonics			Koos

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

Assessment
The assessment takes place in the form of an oral examination (approx. 25 minutes); appointments individually on demand.

Prerequisites
none

T 6.104 Module component: Internship [T-MACH-114409]

Coordinators: Dr. Patric Gruber
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107331 - Internship

Type	Credits	Grading	Term offered	Version
Coursework	12 CP	pass/fail	Each term	1

Exams			
WT 25/26	76-T-MACH-114409	Internship	Gruber
ST 2026	76-T-MACH-114409	Internship	Gruber

Assessment
Presentation of the internship documents (training contract, activity report, internship certificate) as well as placement of an internship report in the form of a short oral presentation (about 10 min) and a written report.

Prerequisites
none

Additional Information
As part of the master's program, an internship must be completed in accordance with SPO. The compulsory minimum duration is 9 weeks. Missed working hours must be made up in any case. In the case of time off, the trainee should ask the training company for a contract extension in order to be able to get the work experience to the required extent.

The internship office does not convey internships. The students have to contact a company and ask for a suitable internship. The internship relationship becomes legally binding through the training contract to be concluded between the company and the trainee. The contract defines all rights and obligations of the trainee and the training company as well as the type and duration of the work experience. The term “company” is synonymous here with engineering firms, enterprises, authorities etc. However, the internship cannot be completed at a KIT facility.

Workload
360 hours

T 6.105 Module component: Introduction to Bionics [T-MACH-111807]

Coordinators: apl. Prof. Dr. Hendrik Hölscher
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2142151	Introduction to Biomimetics	2 SWS	Lecture / 🗣	Hölscher
Exams					
WT 25/26	76-T-MACH-102172	Introduction into Biomimetics			Hölscher
ST 2026	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 2026, 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 6.106 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	76-T-MACH-114100	Introduction to Microsystem Technology I			Badilita

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 6.107 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2142874	Introduction to Microsystem Technology II	2 SWS	Lecture / 🗣	Korvink, Badilita
Exams					
WT 25/26	76-T-MACH-114101	Introduction to Microsystem Technology II			Badilita

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 2026, 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 6.108 Module component: Introduction to Philosophy of Technology [T-MACH-113883]

Coordinators: Prof. Dr. Dr. Rafaela Hillerbrand
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each winter term	1 semesters	3

Courses					
WT 25/26	5000046	Philosophical Foundations of Technology Assessment: An Introduction to Philosophy of Technology	2 SWS	Seminar / 🗣	Hillerbrand, Frigo
Exams					
WT 25/26	7400565	Philosophy of Technology Assessment - Proseminar			Hillerbrand

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

Assessment
Ungraded coursework in the form of a written assignment and presentation of a flipped classroom session.

Prerequisites
none

Additional Information
The course is offered in English

Workload
60 hours

T 6.109 Module component: Introduction to Philosophy of Technology - Essay [T-MACH-114962]

Coordinators: Prof. Dr. Dr. Rafaela Hillerbrand
Organisation: KIT Department of Electrical Engineering and Information Technology
KIT Department of Mechanical Engineering
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Version
Coursework	1 CP	pass/fail	1

Courses					
WT 25/26	5000046	Philosophical Foundations of Technology Assessment: An Introduction to Philosophy of Technology	2 SWS	Seminar / 🗣	Hillerbrand, Frigo
Exams					
WT 25/26	7400776	Introduction to Philosophy of Technology - Essay			Hillerbrand

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

Assessment
Ungraded coursework in the form of a written essay (approx. 3000 words) with at least six citations that compares and links two topics from the seminar

Prerequisites
The module components "T-MACH-113883 - Introduction to Philosophy of Technology" and "T-MACH-114961 - Introduction to Philosophy of Technology - Homework" must have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-113883 - Introduction to Philosophy of Technology must have been started.
2. The module component T-MACH-114961 - Introduction to Philosophy of Technology - Homework must have been started.

Workload
30 hours

T 6.110 Module component: Introduction to Philosophy of Technology - Homework [T-MACH-114961]

Coordinators: Prof. Dr. Dr. Rafaela Hillerbrand
Organisation: KIT Department of Electrical Engineering and Information Technology
KIT Department of Mechanical Engineering
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Version
Coursework	1 CP	pass/fail	1

Courses					
WT 25/26	5000046	Philosophical Foundations of Technology Assessment: An Introduction to Philosophy of Technology	2 SWS	Seminar / 🗣	Hillerbrand, Frigo
Exams					
WT 25/26	7400775	Introduction to Philosophy of Technology - Homework			Hillerbrand

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

Assessment
Ungraded coursework in the form of written answers to questions and submission during the semester

Prerequisites
The module component "T-MACH-113883 - Introduction to Philosophy of Technology" must have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-113883 - Introduction to Philosophy of Technology must have been started.

Workload
30 hours

T 6.111 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2162282	Introduction to the Finite Element Method	2 SWS	Lecture / 🗣	Langhoff, Böhlke
Exams					
WT 25/26	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

Lecture (V)
On-Site

2162282, WS 25/26, 2 SWS, Language: German, Open in study portal

Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations

Literature

- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- 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 6.112 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2182732	Introduction to Theory of Materials	2 SWS	Lecture / 🗣	Kamlah
Exams					
WT 25/26	76-T-MACH-105321	Introduction to Theory of Materials			Kamlah
ST 2026	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 2026, 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 6.113 Module component: Lab Course in Failure Analysis [T-MACH-114609]

Coordinators: Prof. Dr. Christian Greiner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2182101	Laboratory "Failure Analysis"	2 SWS	Practical course / 🗣	Greiner, Schneider, Dollmann
Exams					
ST 2026	76-T-MACH-114609	Lab Course in Failure Analysis			Greiner, Dollmann, Schneider

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

Assessment
The assessment consists of an overall final colloquium.

Prerequisites
none

Recommendations
The attendance to one of the course Failure Analysis (2181114) 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 Laboratory "Failure Analysis"
2182101, SS 2026, 2 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content
Practical conducting of damage investigations in the laboratory.

Students will acquire knowledge of the necessary investigation methods for conducting damage investigations and will be able to analyze failures, taking into account stress and material resistance. Students will be able to recognize and discuss the most important types of failure and damage patterns.

Participation in the Tribology course (2181114) is recommended.

Classroom time: 35 hours
Self-study: 85 hours

Performance is assessed in the form of a short colloquium on each damage case and a comprehensive final colloquium including a 20-minute presentation.

Organizational issues
Anmeldung per Email bis zum 24.04.2026 an johannes.schneider@kit.edu

Das Praktikum wird nach Absprache mit den Studierenden semesterbegleitend oder als Block am Campus Süd (MZE, 30.48) angeboten.

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, 7. Auflage, Narr Francke Attempto Verlag, 2017, ISBN 978-3-825-25162-8
4. K.G. Schmitt-Thomas: Integrierte Schadenanalyse. 3. Auflage, Springer Vieweg, 2015, ISBN 978-3-662-46133-4, In der KIT-BIB online verfügbar!
5. E. Wendler-Kalsch, H. Gräfen: Korrosionsschadenkunde, Springer-Verlag, 1998, ISBN 3-540-63377-4

T 6.114 Module component: Laboratory Production Metrology [T-MACH-108878]

Coordinators: Dr.-Ing. Martin Benfer
Prof. Dr.-Ing. Gisela Lanza

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	5

Courses					
ST 2026	2150550	Laboratory Production Metrology	3 SWS	Practical course / 🗣	Lanza, Benfer

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

Assessment
Alternative Test Achievement: Group presentation of 15 min at the beginning of each experiment and evaluation of the participation during the experiments

and

Oral Exam (15 min)

Prerequisites
T-MACH-114827 must not have been started.

Additional Information
The course is offered in German.

For organizational reasons the number of participants for the course is limited. Hence al selection process will take place. Applications are made via the homepage of wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

Workload
120 hours

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

V Laboratory Production Metrology

2150550, SS 2026, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site

Content

During this course, students get to know measurement systems that are used in a production system. In the age of Industry 4.0, sensors are becoming more important. Therefore, the application of in-line measurement technology such as machine vision and non-destructive testing is focussed. Additionally, laboratory based measurement technologies such as computed tomography are addressed. The students learn the theoretical background as well as practical applications for industrial examples. The students use sensors by themselves during the course. Additionally, they are trained on how to integrate sensors in production processes and how to analyze measurement data with suitable software.

The following topics are addressed:

- Classification and examples for different measurement technologies in a production environment
- Machine vision with optical sensors
- Information fusion based on optical measurements
- Robot-based optical measurements
- Non-destructive testing by means of acoustic measurements
- Coodinate measurement technology
- Industrial computed tomography
- Measurement uncertainty evaluation
- Analysis of production data by means of data mining

Learning Outcomes:

The students …

- are able to name, describe and mark out different measurement technologies that are relevant in a production environment.
- are able to conduct measurements with the presented in-line and laboratory based measurement systems.
- are able to analyze measurement results and asses the measurement uncertainty of these.
- are able to deduce whether a work piece fulfills quality relevant specifications by analysing measurement results.
- are able to use the presented measurement technologies for a new task.

Workload:

regular attendance: 31,5 hours
self-study: 88,5 hours

Organizational issues

Aus organisatorischen Gründen ist die Teilnehmerzahl für die Lehrveranstaltung begrenzt. Infolgedessen wird ein Auswahlprozess stattfinden. Die Bewerbung erfolgt über die Homepage des wbk (http://www.wbk.kit.edu/studium-und-lehre.php).

For organizational reasons the number of participants for the course is limited. Hence a selection process will take place. Applications are made via the homepage of wbk (KIT - wbk Institute of Production Science Education).

Literature

Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt. Ebenso wird auf gängie Fachliteratur verwiesen.

Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/). Additional reference to literature will be provided, as well.

T 6.115 Module component: Laser Material Processing [T-MACH-112763]

Coordinators: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2182642	Laser Material Processing	2 SWS	Lecture / 🗣	Schneider
Exams					
WT 25/26	76-T-MACH-112763	Laser Material Processing			Schneider
ST 2026	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.

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 2026, 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 6.116 Module component: Laser Metrology [T-ETIT-100643]

Coordinators: Prof. Dr. Marc Eichhorn
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2303200	Laser Metrology	2 SWS	Lecture / 🗣	Eichhorn
Exams					
WT 25/26	7303200	Laser Metrology			Eichhorn

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

Assessment
The exam will be taken as an oral examination (about 20 minutes). The individual appointments for examination are offered at two previously determined dates.

Prerequisites
none

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

V Laser Metrology

2303200, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Current time schedule can be found in ILIAS

Organizational issues
Beginn am Do. 30. April 2026, 9:45 - 13:15

Seminarraum IRS, Raum 119 Geb. 30.33.

Weitere Details werden in ILIAS bekannt gegeben. Prüfungen werden ebenfalls über ILIAS organisiert

Starting on Thursday, 30th April, 9:45 - 13:15

Room 119, Building 30.33

Further details are annouced in ILIAS. Exam registration will also be organised via ILIAS.

T 6.117 Module component: Laser-Assisted Methods and Their Application for Energy Storage Materials [T-MACH-106739]

Coordinators: Prof. Wilhelm Pfleging
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2193013	Laser-assisted methods and their application for energy storage materials	2 SWS	Lecture / 🗣	Pfleging
ST 2026	2193013	Laser-assisted methods and their application for energy storage materials	2 SWS	Lecture / ⧉	Pfleging
Exams					
WT 25/26	76-T-MACH-106739	Laser-assisted methods and their application for energy storage materials			Pfleging

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

Assessment
oral exam (about 30 min)

Prerequisites
none

Recommendations
Fundamentals of solid state physics and optics

Additional Information
The course is in English.

Workload
120 hours

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

V Laser-assisted methods and their application for energy storage materials

Lecture (V)
On-Site

2193013, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
Registration via ILIAS or by e-mail to: pfleging@kit.edu

consulting-hour: Wednesdays after the lecture, 4 - 5 p.m.; Campus South, building 10.50, room 603.2

Oral Examination: ca. 30 min

Teaching Content:

- Optics and beam shaping
- Laser-induced plasma
- Thermal-assisted laser materials processing
- Functionalization of surfaces
- Self-organized processes
- Fundamental aspects of battery technology
- Laser processes in battery manufacturing
- Advanced concepts for high energy and high power batteries
- Laser-based post-mortem analytics

Recommendations: Basics of Solid State Physics and Optics

- Attendance in Lecture: 18 Stunden
- Extra Requirements: 98 Stunden

Laser technology is a cutting-edge field with a wide range of applications. This course covers innovative laser processes, including cutting, welding, and structuring, at the micro and nanometer scale. It also discusses different laser beam sources and their integration into battery production. The students are equipped with comprehensive tools to independently evaluate, design, and optimize a process. The laser group at KIT is the only one that provides such extensive training on the use of state-of-the-art beam sources in battery production in an application-oriented manner.

Organizational issues
You will receive the lecture material and further information via ILIAS

Literature

- Laser in der Fertigung, Grundlagen der Strahlquellen, Systeme, Fertigungsverfahren, Autoren: Hügel, Helmut, Graf, Thomas, ISBN 978-3-8348-1817-1, Springer Verlag, 2014
- Laser Processing and Chemistry, Autor: Bäuerle, Dieter W., ISBN 978-3-642-17613-5, Springer, 2011
- Handbuch Lithium-Ionen-Batterien, Korthauer, Reiner (Hrsg.), ISBN 978-3-642-30653-2, Springer Verlag, 2013
- Lithium-ion Battery Materials and Engineering, Autoren: Malgorzata K. Gulbinska, ISBN 978-1-4471-6548-4, Springer Verlag, 2014
- Laser-Induced Breakdown Spectroscopy, Theory and Applications, Autoren: Sergio Musazzi, Umberto Perini, Springer Series in Optical Sciences, ISBN 978-3-642-45084-6, 2007

V **Laser-assisted methods and their application for energy storage materials**
2193013, SS 2026, 2 SWS, Language: English, Open in study portal

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

Content
Oral Examination: ca. 30 min

Teaching Content:

- Optics and beam shaping
- Laser-induced plasma
- Thermal-assisted laser materials processing
- Functionalization of surfaces
- Self-organized processes
- Fundamental aspects of battery technology
- Laser processes in battery manufacturing
- Advanced concepts for high energy and high power batteries
- Laser-based post-mortem analytics

Recommendations: Basics of Solid State Physics and Optics

- Attendance in Lecture: 18 Stunden
- Extra Requirements: 98 Stunden

The students will get an in-depth insight into the various aspects of modern laser technology and laser beam-material interactions. They will get knowledge about the use of laser radiation for functionalization of modern energy storage materials for batteries. They get used handling of scientific methods for describing the physical processes which is communicated in an application-oriented manner.

Organizational issues
The lecture will take place in building 30.28, room R220
The lecture can possibly take place online. Find out more on ILIAS.
Register if possible by April 14, 2026 by email to pfleging@kit.edu or via ILIAS.

Literature

- Laser in der Fertigung, Grundlagen der Strahlquellen, Systeme, Fertigungsverfahren, Autoren: Hügel, Helmut, Graf, Thomas, ISBN 978-3-8348-1817-1, Springer Verlag, 2014
- Laser Processing and Chemistry, Autor: Bäuerle, Dieter W., ISBN 978-3-642-17613-5, Springer, 2011
- Handbuch Lithium-Ionen-Batterien, Korthauer, Reiner (Hrsg.), ISBN 978-3-642-30653-2, Springer Verlag, 2013
- Lithium-ion Battery Materials and Engineering, Autoren: Malgorzata K. Gulbinska, ISBN 978-1-4471-6548-4, Springer Verlag, 2014
- Laser-Induced Breakdown Spectroscopy, Theory and Applications, Autoren: Sergio Musazzi, Umberto Perini, Springer Series in Optical Sciences, ISBN 978-3-642-45084-6, 2007

T 6.118 Module component: Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113578]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	1

Courses					
ST 2026	1130716	Lecture series Science in Society	2 SWS	Lecture / 🗣	Post, Mielke

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

Assessment
Active participation, learning protocols, if applicable.

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:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
It is recommended that you complete the lecture series "Science in Society" before attending events in the advanced module and in parallel with attending the basic seminar.
If it is not possible to attend the lecture series and the basic seminar in the same semester, the lecture series can also be attended after attending the basic seminar.
However, attending events in the advanced module before attending the lecture series should be avoided.

Additional Information
The basic module consists of the lecture series "Science in Society" and the basic seminar. The lecture series is only offered during the summer semester.
The basic seminar can be attended in the summer or winter semester.

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

V Lecture series Science in Society

Lecture (V)
On-Site

1130716, SS 2026, 2 SWS, Language: German, Open in study portal

Content
The lectures are also expected to be available in English via Lecture Translator.

Organizational issues
Anmeldung erforderlich unter: https://plus.campus.kit.edu/signmeup/procedures/6078

T 6.119 Module component: Light and Display Engineering [T-ETIT-100644]

Coordinators: Dr.-Ing. Rainer Kling
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2313747	Light and Display Engineering	2 SWS	Lecture / 🗣	Kling
WT 25/26	2313749	Practical Exercises to 2313747 Light and Display Engineering	1 SWS	Practice / 🗣	Kling
Exams					
WT 25/26	7313747	Light and Display Engineering			Kling, Neumann

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

Assessment
Type of Examination: Oral exam

Duration of Examination: approx. 25 minutes

Modality of Exam: The oral exam is flexibly held by student request after the WS.

Prerequisites
none

T 6.120 Module component: Lightweight Design Workshop: Simulation and Manufacturing [T-MACH-114439]

Coordinators: Prof. Dr.-Ing. Luise Kärger
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2113111	Lightweight Design Workshop: Simulation and Manufacturing	4 SWS	Lecture / Practice / 🗣	Kärger, Liebig
Exams					
WT 25/26	76-T-MACH-114439	Lightweight Design Workshop: Simulation and Manufacturing			Liebig, Kärger

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

Assessment
oral exam (about 25 minutes)

Prerequisites
T-MACH-114005 and T-MACH-114460 must not be started.

Recommendations

- Materials of Lightweight Construction
- Structural Analysis of Composite Laminates
- Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies

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 Design Workshop: Simulation and Manufacturing

2113111, WS 25/26, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content

The cooperative educational concept of the FAST-LB and IAM-WK give students an understanding of theory and practice for lightweight constructing with fiber-reinforced-polymers. Students solve an engineering lightweight task in small groups (max. 4 p.), for example the construction of an optimal bending beam under certain space and weight conditions. Various Materials (fibers, resins, foams, etc.) as well as relevant material data are provided and can be used any arbitrary combination. Mechanical properties of the semi-finished fiber products are to be determined by supervised tests on coupon samples. In a first step, students develop a theoretical solution and verify it simulative. Therefore, an introductory basic lecture teaches the mechanics and simulations techniques of fiber-reinforced-polymers. In a second step the students manufacture specimens based on their theoretical solution at the IAM-WK. The specimens are then tested on bending machines. The students gain knowledge about fiber-reinforced-polymers (materials, manufacturing, manufacturing effects, restrictions, etc.) and structural analysis simulations (modelling, simplifications, assumptions, material models, etc.) as well as material characterization and testing. Building on the basic lecture the knowledge is gained autonomously by solving realistic practice relevant tasks. The main topics are

- Fundamentals of lightweight strategies
- Basics of fiber-reinforced-polymers
- Basics of FEM simulation with anisotropic multi-material systems
- Independent development of suitable component concepts in teams of 4
- Independent development of simulation models for verification and design of own component concepts
- Calculation of anisotropic stiffness parameters from characterization tests
- Manufacturing of fiber-reinforced-polymers
- Mechanical testing

Learning Objectives

Students will be able to name and explain lightweight design strategies. They are familiar with typical fiber and matrix materials and their function in fiber composite materials. They will be familiar with the operating principle of a sandwich composite with foam core and will be able to describe and justify typical deformation and stress curves. They can name characteristic mechanical parameters and manufacturing processes. For the numerical analysis of FRP components, the students know simple laminate theories, they can set up a finite element model in Abaqus, select suitable finite elements, evaluate the simulation results and derive conclusions for improving the load-bearing effect. Students know the main steps and boundary conditions for manual fabrication and mechanical testing of fiber composite sandwich structures and can apply them in practice. They learn to work independently in teams on an open task, to elaborate the necessary boundary conditions and parameters and to obtain additional information where necessary.

T 6.121 Module component: Localization of Mobile Agents [T-INFO-115014]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	6 CP	graded	Each summer term	1 semesters	2

Assessment
The assessment is carried out as an oral examination, lasting 15-30 minutes in accordance with Section 4 (2) No. 2 SPO. Participants can contact the chair at any time to arrange an appointment for the oral examination. (§ 4 Abs. 2 Nr. 2 SPO)

Prerequisites
T-INFO-115015 Digital exercise must be successfully completed before exam.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-INFO-115015 - Localization of Mobile Agents - Pass must have been started.

Recommendations
Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

T 6.122 Module component: Localization of Mobile Agents - Pass [T-INFO-115015]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

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

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must complete a digital exercise in Ilias which is ungraded. The digital exercise can be repeated as often as desired.

Prerequisites
None.

Recommendations
Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

T 6.123 Module component: Master's Thesis [T-MACH-114410]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107332 - Master's Thesis

Type	Credits	Grading	Term offered	Version
Final Thesis	30 CP	graded	Each term	1

Assessment

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

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

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

The master thesis is to be evaluated by not less than a professor from KIT or habilitated member of the KIT Department of Mechanical Engineering and another examiner. Generally, one of the two examiners is the person who has assigned the thesis.

If the examiners do not agree, the master thesis is graded by the examination board within this assessment; another expert can be appointed too. The master thesis has to be graded within a period of eight weeks after the submission.

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

Prerequisites

The requirement for admission to the master thesis module are 74 ECTS. As to exceptions, the examination board decides on a request of the student.

Final Thesis

This module component represents a final thesis. The following periods have been supplied:

Submission deadline	6 months
Maximum extension period	3 months
Correction period	8 weeks

Workload

900 hours

T 6.124 Module component: Materials and Processes for Electrochemical Storage [T-CIWVT-108146]

Coordinators: Prof. Dr. Jens Tübke
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2245840	Materials and Processes for Electrochemical Storage	2 SWS	Lecture / 🗣	Tübke
Exams					
WT 25/26	7245840	Materials for Electrochemical Storage			Tübke
ST 2026	7245840	Materials and Processes for Electrochemical Storage			Tübke

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

Assessment
Learning control is an oral exam lasting approx. 30 minutes.

Prerequisites
None

T 6.125 Module component: Materials in Additive Manufacturing [T-MACH-110165]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2173600	Materials in Additive Manufacturing	2 SWS	Lecture / 🗣	Dietrich
Exams					
WT 25/26	76-T-MACH-110165	Materials in Additive Manufacturing			Dietrich
ST 2026	76-T-MACH-110165	Materials in Additive Manufacturing			Dietrich

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 Materials in Additive Manufacturing

2173600, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
learning objectives:

requirements:
none

workload:

T 6.126 Module component: Materials Modelling: Dislocation Based Plasticity [T-MACH-105369]

Coordinators: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2182740	Materials modelling: dislocation based plasticity	2 SWS	Lecture / 🗣	Weygand
Exams					
WT 25/26	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticity			Weygand
WT 25/26	76-T-MACH-105369_WS	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 2026, 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 6.127 Module component: Materials of Lightweight Construction [T-MACH-105211]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174574	Materials of Lightweight Construction	2 SWS	Lecture / 🗣	Liebig
Exams					
WT 25/26	76-T-MACH-105211	Materials of Lightweight Construction			Liebig
ST 2026	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 2026, 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 6.128 Module component: Materials Recycling and Sustainability [T-MACH-110937]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2173520	Materials Recycling and Sustainability	2 SWS	Lecture / 🗣	Liebig
Exams					
WT 25/26	76-T-MACH-110937	Materials Recycling and Sustainability			Liebig
ST 2026	76-T-MACH-110937	Materials Recycling and Sustainability			Liebig

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

Assessment
oral exam (about 25 min.)

Prerequisites
T-MACH-114012 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 Recycling and Sustainability

2173520, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The lecture series is organised in two main topics: On the one hand, fundamentals of sustainability are explained and it is shown how to tread more sustainable paths in materials science and mechanical engineering. On the other hand, separation and recycling processes for all common classes of materials are presented and discussed. It is shown how recycling fosters a holistic and sustainable perspective on material processing and use.

1. legal bases and historical background
2. climate change, ecology and material flows
3. sustainability in general
4. product responsibility, recyclable design and planned obsolescence
5. general and legal bases of recycling
6. material separation, sorting and processing
7. recycling of metals
8. recycling of polymers and composites
9. recycling of everyday materials
10. alternative materials and alternative design concepts
11. materials for renewable energy sources

Literature
Skript wird in der Vorlesung ausgegeben

6.129 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2162280	Mathematical Methods in Micromechanics	2 SWS	Lecture / 🗣	Böhlke, Kehrer

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 2026, 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 6.130 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-103622	Measurement and Control Systems			Stiller
ST 2026	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)** 3137021, WS 25/26, 1 SWS, Language: English, Open in study portal	**Practice (Ü)** **On-Site**

Content
Tutorial for Measurement and Control Systems

T 6.131 Module component: Measurement Techniques in the Thermo-Fluid Dynamics [T-CIWVT-108837]

Coordinators: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2232040	Diagnostics in Thermal Fluid Dynamics	2 SWS	Lecture / 🗣	Trimis
WT 25/26	2232041	Exercises for 2232040 Diagnostics in Thermal Fluid Dynamics	1 SWS	Practice / 🗣	Trimis
Exams					
WT 25/26	7232040	Measurement Techniques in the Thermo-Fluid Dynamics			Trimis
ST 2026	7232040	Measurement Techniques in the Thermo-Fluid Dynamics			Trimis

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

Prerequisites
None

T 6.132 Module component: Mechanical Properties of Nanomaterials and Microsystems [T-MACH-114018]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2178420	Mechanical Properties of Nanomaterials and Microsystems	2 SWS	Lecture / 🗣	Kirchlechner, Gruber, Greiner, Okotete, Weygand
Exams					
WT 25/26	76-T-MACH-114018	Mechanical Properties of Nanomaterials and Microsystems			Kirchlechner, Weygand, Gruber
ST 2026	76-T-MACH-114018	Mechanical Properties of Nanomaterials and Microsystems			Kirchlechner, Gruber, Weygand

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

Assessment
oral exam ca. 30 minutes

Prerequisites
Mutual exclusion with T-MACH-114071

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114071 - Mechanical Properties of Nanomaterials and Microsystems (in German) 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 Mechanical Properties of Nanomaterials and Microsystems

Lecture (V)
On-Site

2178420, SS 2026, 2 SWS, Language: English, Open in study portal

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 22, 2026.

Literature

1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials

T 6.133 Module component: Mechanical Properties of Nanomaterials and Microsystems (in German) [T-MACH-114071]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	76-T-MACH-114071	Mechanical Properties of Nanomaterials and Microsystems			Gruber, Kirchlechner, Weygand
ST 2026	76-T-MACH-114071	Mechanical Properties of Nanomaterials and Microsystems (in German)			Kirchlechner, Gruber, Weygand

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

Assessment
Oral examination, ca. 30 min

Prerequisites
Course T-MACH-114018 must not have been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114018 - Mechanical Properties of Nanomaterials and Microsystems 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 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 6.134 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2305263	Medical Imaging Technology	4 SWS	Lecture / Practice / 🗣	Spadea, Arndt
Exams					
WT 25/26	7305260	Medical Imaging Technology			Spadea
ST 2026	7305260	Medical Imaging Technology			Spadea, Arndt

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 6.135 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-107326 - MINT Elective Module

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					
WT 25/26	7305270	Medizinische Messtechnik			Nahm
ST 2026	7305270	Medical Measurement Technology			Nahm

Legend: 🖥 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, x 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 6.136 Module component: Metal Forming [T-MACH-105177]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2150681	Metal Forming	2 SWS	Lecture / 🗣	Herlan
Exams					
WT 25/26	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

2150681, SS 2026, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 6.137 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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
Exams					
WT 25/26	76-T-MACH-105782	Micro Magnetic Resonannce			Korvink, MacKinnon

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 6.138 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-107325 - Properties

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, Avadanii, Bansal, Sarebanzadeh, Vrellou, Gruber
Exams					
WT 25/26	76-T-MACH-114399	Microstructure-Property-Relationships			Kirchlechner, Gruber
ST 2026	76-T-MACH-114399	Microstructure-Property-Relationships			Kirchlechner, 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-114398 - Microstructure-Property-Relationships (in German) must not have been started.
2. The module component T-MACH-114408 - Exercises for Microstructure-Property-Relationships must have been passed.
3. The module component T-MACH-114407 - Exercises for Microstructure-Property-Relationships (in German) must not have been started.

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

Organizational issues
Please note the following change: The lecture begins now on Monday, October 27, 2025.

T 6.139 Module component: Microstructure-Property-Relationships (in German) [T-MACH-114398]

Coordinators: Dr. Patric Gruber
Prof. Dr. Christoph Kirchlechner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107325 - Properties

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

Courses					
ST 2026	2178124	Microstructure-Property-Relationships	3 SWS	Lecture / 🗣	Kirchlechner, Gruber
Exams					
ST 2026	76-T-MACH-114398	Microstructure-Property-Relationships (in German)			Kirchlechner, Gruber

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

Assessment
Oral exam (about 30 min)

Prerequisites
The successful participation in T-MACH-114407 – Übungen zu Gefüge-Eigenschafts-Beziehungen is the condition for the admittance to the oral exam in Gefüge-Eigenschafts-Beziehungen.

T-MACH-114408 – Exercises for Microstructure-Property-Relationships has not been started.

T-MACH-114399 - Microstructure-Properties-Relationships has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114399 - Microstructure-Property-Relationships must not have been started.
2. The module component T-MACH-114408 - Exercises for Microstructure-Property-Relationships must not have been started.
3. The module component T-MACH-114407 - Exercises for Microstructure-Property-Relationships (in German) must have been passed.

Additional Information
The course is offered in German.

Workload
150 hours

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

V Microstructure-Property-Relationships

2178124, SS 2026, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The following microstructure-property-relationships will be discussed for all material classes:

- Elasticity and plasticity

- Fracture mechanics

- Fatigue

- Creep

- Elektrical conductivity: Metallic conductors, semiconductors, superconductors, conductive polymers

- Magnetic propetries 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

Organizational issues
Die Vorlesung beginnt am Dienstag, den 21.04.2026.

T 6.140 Module component: Microsystem Simulation [T-MACH-108383]

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

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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 6.141 Module component: Mobile Computing and Internet of Things [T-INFO-102061]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	7

Courses					
WT 25/26	2400051	Mobile Computing and Internet of Things		Lecture / Practice	Beigl, Röddiger
Exams					
WT 25/26	7500287_1	Mobile Computing and Internet of Things			Beigl
ST 2026	7500350	Mobile Computing and Internet of Things			Beigl

Assessment
The assessment is carried out as a written exam (of approx. 60 minutes) as a digital exam according to §2 (3) of the Statute for the implementation of online examinations. The exam takes place ON SITE at KIT!

Prerequisites
Exercise certificate must be submitted.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-INFO-113119 - Mobile Computing and Internet of Things - Exercise must have been started.

Workload
90 hours

T 6.142 Module component: Mobile Computing and Internet of Things - Exercise [T-INFO-113119]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2400051	Mobile Computing and Internet of Things		Lecture / Practice	Beigl, Röddiger
Exams					
WT 25/26	7500358	Mobile Computing and Internet of Things			Beigl

Additional Information
Exercise certificate can only be credited in combination with the exam(T-INFO-102061 - Mobile Computing and Internet of Things). This part of the course cannot be taken individually.

Workload
60 hours

T 6.143 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2305302	Modeling Physiological Systems	2 SWS	Lecture / 🗣	Loewe
Exams					
ST 2026	7305302	Modeling Physiological Systems			Loewe

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

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 6.144 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2305303	Exercise to 2305302 Modeling Physiological Systems	1 SWS	Practice / 🗣	Loewe, Kruthoff
Exams					
ST 2026	7305303	Modeling Physiological Systems - Workshop			Loewe

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

Assessment
Success control takes place in the form of ungraded course works. The workshop tasks (3 exercise sheets) must be submitted.

Prerequisites
none

Additional Information
This success control must be passed in order to register for the written examination.

T 6.145 Module component: Modern Characterization Methods for Materials and Catalysts [T-CHEMBIO-107822]

Organisation: KIT Department of Chemistry and Biosciences

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

T 6.146 Module component: Multi-Scale Plasticity [T-MACH-105516]

Coordinators: Prof. Dr. Christian Greiner
Prof.PD Dr.Ing. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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
Exams					
WT 25/26	76-T-MACH-105516	Multi-Scale Plasticity			Schulz, Greiner

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 6.147 Module component: Nano-Optics [T-PHYS-102282]

Coordinators: PD Dr. Andreas Naber
Organisation: KIT Department of Physics
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	4020021	Nano-Optics	3 SWS	Lecture / 🗣	Naber
WT 25/26	4020022	Exercises to Nano-Optics	1 SWS	Practice / 🗣	Naber
Exams					
WT 25/26	7800099	Nano-Optics			Naber

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

Prerequisites
none

T 6.148 Module component: Non-destructive Materials Testing [T-MACH-114968]

Coordinators: Dr.-Ing. Stefan Dietrich
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174512	Non-destructive Materials Testing	4 SWS	Lecture / 🗣	Dietrich
Exams					
ST 2026	76-T-MACH-114968	Non-destructive Materials Testing			Dietrich

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 Non-destructive Materials Testing

Lecture (V)
On-Site

2174512, SS 2026, 4 SWS, Language: German, Open in study portal

Content

• Overview of NDT methods: visual, ultrasonic, radiographic (X-ray, CT), eddy current, magnetic particle, thermography

• Material properties and defect types relevant to NDT

• Signal processing and image interpretation in testing

• Role of NDT in quality assurance, predictive maintenance, and lifecycle monitoring

• On-machine testing concepts and integration into manufacturing systems

• Data acquisition, digital evaluation and interfaces to quality systems

• Use cases from aerospace, automotive, additive manufacturing, and civil engineering

• Practical sessions with selected NDT equipment (ultrasound, electromagnetic, X-ray diffraction)

Learning objectives:

• This course provides a comprehensive overview of non-destructive testing (NDT) methods and their role in quality assurance and process monitoring, with a strong focus on sustainable and circular production contexts

• Students understand the working principles of key NDT methods and their applications in process and product control

• They can critically evaluate NDT techniques with respect to defect detection, resolution, and applicability

• They gain practical experience in applying NDT techniques in lab settings

• They understand how NDT enables condition-based maintenance, life extension, and circularity strategies

Organizational issues

In der letzten Vorlesungswoche finden praktische Übungen zur zerstörungsfreien Prüftechnik im Rahmen einer 3-tägigen Blockveranstaltung in Rücksprache mit den Teilnehmern statt.

T 6.149 Module component: Non-ferrous Metals and Alloys [T-MACH-114956]

Coordinators: Prof. Dr.-Ing. Martin Heilmaier
Dr. Emma White

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174555	Non-ferrous Metals and alloys	3 SWS	Lecture / 🗣	Heilmaier, White
Exams					
ST 2026	76-T-MACH-114956	Non-ferrous Metals and Alloys			Heilmaier

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

Assessment
oral exam (about 25 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 Non-ferrous Metals and alloys

Lecture (V)
On-Site

2174555, SS 2026, 3 SWS, Language: English, Open in study portal

Content
This lecture gives an introduction in the material physics of non-ferrous metals and alloys. Focus is placed on:

- Synthesis and manufacturing
- Constitution (phase diagrams)
- Microstructure
- Mechanical and physical properties

which determine their respective applications. Since the students get an overview of the potentials and limitations of non-ferrous metals and alloys, they will receive the expertise to assess and decide about their different possible fields of applications.

Literature
Materialkunde der Nichteisenmetalle und Legierungen, J. Freudenberger und M. Heilmaier, Wiley-VCH 2020 (auf Deutsch)

T 6.150 Module component: Nonlinear Continuum Mechanics [T-MACH-111026]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2162344	Nonlinear Continuum Mechanics	2 SWS	Lecture / 🗣	Böhlke
Exams					
WT 25/26	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.

Recommendations
If you intend to take the course "Computational Elasticity" (T-MACH-113989) or "Computational Inelasticity" (T-MACH-113989) within the elective part of the focus field "Computational and Applied Mechanics" (M-MACH-106976) , it is recommend to first take the course "Nonlinear Continuum Mechanics" (T-MACH-111026)

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 2026, 2 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
Mit Zustimmung aller Teilnehmenden kann die Lehrveranstaltung auch auf Deutsch gehalten werden.

Falls Sie planen, im Ergänzungsbereich des Schwerpunkts "Computerbasierte und angewandte Mechanik" (M-MACH-106976) eine der Lehrveranstaltungen "Computational Elasticity" (T-MACH-113989) oder "Computational Inelasticity" (T-MACH-113989) zu belegen, wird empfohlen, die Lehrveranstaltung "Nonlinear Continuum Mechanics" (T-MACH-111026) als Kernfach im Schwerpunkt "Computerbasierte und angewandte Mechanik" (M-MACH-106976) vorher zu belegen.

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 6.151 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	76-T-MACH-102152	Novel Actuators and Sensors			Kohl, Sommer
ST 2026	76T-MACH-102152_2	Novel Actuators and Sensors			Kohl

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 6.152 Module component: Optical Engineering and Machine Vision [T-ETIT-113941]

Coordinators: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2302150	Optical Engineering and Machine Vision	3 SWS	Lecture / 🗣	Heizmann
WT 25/26	2302151	Tutorial to 2302150 Optical Engineering and Machine Vision	1 SWS	Practice / 🗣	Leyer
Exams					
WT 25/26	7302150	Optical Engineering and Machine Vision			Heizmann

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

Assessment
The examination takes place in form of a written examination lasting 120 (KSOP/O&P: 90) minutes.

The module grade is the grade of the written examination.

Prerequisites
none

T 6.153 Module component: Optical Transmitters and Receivers [T-ETIT-100639]

Coordinators: Prof.Dr.Dr.h.c. Wolfgang Freude
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2309460	Optical Transmitters and Receivers	2 SWS	Lecture / 🗣	Freude
WT 25/26	2309461	Tutorial for 2309460 Optical Transmitters and Receivers	2 SWS	Practice / 🗣	Freude, N.N.
Exams					
WT 25/26	7309460	Optical Transmitters and Receivers			Freude
ST 2026	7309460	Optical Transmitters and Receivers			Freude

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

Assessment
Access controll takes placein form of an overall oral examination (approx. 20 minutes). The individual dates for the oral examination are offered regularly.

Prerequisites
none

Recommendations
Knowledge of the physics of the pn-transition.

T 6.154 Module component: Opto- and Nanoelectronic Devices [T-ETIT-114165]

Coordinators: Prof. Dr. Ulrich Lemmer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2313770	Opto- and Nanoelectronic Devices	3 SWS	Lecture / 🗣	Lemmer
ST 2026	2313771	Exercise for 2313770 Opto- and Nanoelectronic Devices	1 SWS	Practice / 🗣	Lemmer
Exams					
ST 2026	7313707	Opto- and Nanoelectronic Devices			Lemmer

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

Assessment
Success control takes place in the form of a written examination lasting 90 minutes.

The module grade is the grade of the written examination.

Prerequisites
Knowledge of quantum mechanics and solid state electronics is required (e.g. from "M-ETIT-106345 - Festkörperelektronik und Bauelemente")

T 6.155 Module component: Optoelectronic Components [T-ETIT-101907]

Coordinators: TT-Prof. Dr. Tobias Huber-Loyola
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2309486	Optoelectronic Components	2 SWS	Lecture / Blended	Huber-Loyola
ST 2026	2309487	Optoelectronic Components (Tutorial)	1 SWS	Practice / Blended	Huber-Loyola
Exams					
WT 25/26	7300023	Optoelectronic Components			Randel
WT 25/26	7309486	Optoelectronic Components			Randel
ST 2026	7309486	Optoelectronic Components			Randel

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

Assessment
Type of Examination: oral exam

Duration of Examination: approx. 30 minutes

Modality of Exam: Oral examination, usually one examination day per month during the Summer and Winter terms. An extra questions-and-answers session will be held if students wish so.

Prerequisites
none

Recommendations
Minimal background required: Calculus, differential equations, Fourier transforms and p-n junction physics.

T 6.156 Module component: Organic and Flexible Electronics [T-ETIT-114638]

Coordinators: Prof. Dr. Gerardo Hernandez Sosa
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2313768	Organic and Flexible Electronics	2 SWS	Lecture / 🗣	Hernandez Sosa
Exams					
WT 25/26	7313710	Organic and Flexible Electronics			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. 20 minutes).

Prerequisites
none

Recommendations
Knowledge of semiconductor components

T 6.157 Module component: Particle Dynamics and Atomistic Simulation [T-MACH-114129]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2181740	Particle Dynamics and Atomistic Simulation	3 SWS	Lecture / Practice / 🗣	Weygand, Gumbsch

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

Assessment
Oral exam: approximately 30 minutes

Prerequisites
none

Recommendations
Recommended prerequisites: 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 2026, 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 6.158 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	76-T-MACH-111391	Phase Transformations in Materials			Heilmaier, Sen
ST 2026	76-T-MACH-111391	Phase Transformations in Materials			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 6.159 Module component: Phase-Field Method in Thermomechanics [T-MACH-113694]

Coordinators: Dr.-Ing. Andreas Prahs
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2183705	Phase-field method in thermomechanics	3 SWS	Lecture / 🗣	Prahs
Exams					
WT 25/26	76-T-MACH-113694	Phasenfeldmethode in der Thermomechanik			Prahs

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

Assessment
Oral examination, duration approximately 30 minutes

Prerequisites
none

Additional Information
The course is offered in German.

Workload
120 hours

T 6.160 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2313737	Photovoltaics	3 SWS	Lecture / 🗣	Powalla, Lemmer
ST 2026	2313738	Tutorial 2313737 Photovoltaik	1 SWS	Practice / 🗣	Powalla, Lemmer
Exams					
WT 25/26	7313737	Photovoltaics			Powalla, Lemmer
ST 2026	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 6.161 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-107326 - MINT Elective Module

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					
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**
2189906, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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 6.162 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-107326 - MINT Elective Module

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					
WT 25/26	76-T-MACH-102102	Physical Basics of Laser Technology			Schneider
ST 2026	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.

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 6.163 Module component: Physics, Technology and Applications of Thin Films [T-ETIT-111237]

Coordinators: Dr. Konstantin Ilin
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2312710	Physics, Technology and Application of Thin Films	2 SWS	Lecture / 🗣	Ilin
WT 25/26	2312711	Exercise for 2312710 Physics, Technology and Application of Thin Films	1 SWS	Practice / 🗣	Ilin
Exams					
WT 25/26	7312710	Physics, Technology and Applications of Thin Films			Ilin

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

Assessment
The success control takes place within the framework of an oral overall examination of approx. 20 minutes.

T 6.164 Module component: Physiology and Anatomy for Biomedical Engineering [T-ETIT-111815]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2305281	Physiology and Anatomy for Engineers I	2 SWS	Lecture / 🗣	Nahm
ST 2026	2305282	Physiology and Anatomy for Engineers II	2 SWS	Lecture / 🗣	Nahm
Exams					
WT 25/26	7305283	Physiology and Anatomy for Biomedical Engineering			Nahm
ST 2026	7305283	Physiology and Anatomy for Biomedical Engineering			Nahm

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

Assessment
The exmaniation is carried out in the form of a written test of 120 minutes.

The examination includes the contents of Physiologie und Anatomie I (offered every winter term) and Physiologie und Anatomie II (offered every summer term).

Prerequisites
The courses "T-ETIT-101932 - Physiologie und Anatomie I" und "T-ETIT-101933 - Physiologie und Anatomie II" must not been started.

Additional Information
Winter/summer term:

WT: Physiologie und Anatomie I
ST: Physiologie und Anatomie II

T 6.165 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each summer term	1

Courses					
ST 2026	2173648	Plasticity of Metals and Intermetallics	4 SWS	Lecture / 🗣	Heilmaier, Schliephake, Sen
Exams					
WT 25/26	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Heilmaier, Schliephake
ST 2026	76-T-MACH-110818	Plasticity of Metals and Intermetallics			Heilmaier, Schliephake
ST 2026	76-T-MACH-110818-W	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

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 2026, 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 6.166 Module component: Polymer Engineering I [T-MACH-102137]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	76-T-MACH-102137	Polymer Engineering I			Liebig
ST 2026	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 — **Lecture (V) On-Site**
2173590, WS 25/26, 2 SWS, Language: German, Open in study portal

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 6.167 Module component: Polymer Engineering II [T-MACH-102138]

Coordinators: Dr.-Ing. Wilfried Liebig
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174596	Polymer Engineering II	2 SWS	Lecture / 🗣	Liebig
Exams					
WT 25/26	76-T-MACH-102138	Polymerengineering II			Liebig
ST 2026	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 2026, 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 6.168 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-107326 - MINT Elective Module

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					
WT 25/26	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 6.169 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-107326 - MINT Elective Module

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 / Blended	Worgull
Exams					
WT 25/26	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 6.170 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2142855	Polymers in MEMS C - Biopolymers and Bioplastics	2 SWS	/ 🖥	Worgull
Exams					
WT 25/26	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 2026, 2 SWS, Language: German, Open in study portal **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 6.171 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-107326 - MINT Elective Module

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

Exams			
WT 25/26	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	Ott
ST 2026	76-T-MACH-105216	Drive Systems Engineering B: Stationary Machinery	Albers, Ott

Assessment
written examination: 60 min duration

Prerequisites
None

Additional Information
The course is offered in German.

Workload
120 hours

T 6.172 Module component: Practical Aspects of Electrical Drives [T-ETIT-100711]

Coordinators: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2306311	Practical Aspects of Electrical Drives	2 SWS	Lecture / 🗣	Brodatzki
WT 25/26	2306313	Tutorial to 2306311 Practical Aspects of Electrical Drives	1 SWS	Practice / 🗣	Schneider
Exams					
WT 25/26	7306313	Practical Aspects of Electrical Drives			Doppelbauer, Brodatzki
ST 2026	7306311	Practical Aspects of Electrical Drives			Doppelbauer, Brodatzki

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

Prerequisites
none

Additional Information
Shift from SoSe to WiSe, does not take place in WiSe24/25 and SoSe25.

T 6.173 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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 6.174 Module component: Practical in Additive Manufacturing for Process Engineering [T-CIWVT-110903]

Coordinators: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Version
Coursework (practical)	1 CP	pass/fail	1

Courses					
ST 2026	2241021	Practical in Additive Manufacturing for Process Engineering	1 SWS	Practical course / 🗣	Klahn
Exams					
ST 2026	7241021	Practical in Additive Manufacturing for Process Engineering			Klahn

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

Assessment
Learning control is an ungraded completed coursework: Lab, 8 experiments.

T 6.175 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
ST 2026	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course / 🗣	Last
Exams					
WT 25/26	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology			Last
ST 2026	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 approx. 60 minutes.

Prerequisites
none;
Mutual exclusion to T-MACH-108312 - Laboratory practical course on fundamentals of microsystems technology (ungraded)

Workload
90 hours

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

V Introduction to Microsystem Technology - Practical Course

Practical course (P)
On-Site

2143875, WS 25/26, 2 SWS, Language: German, Open in study portal

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 "Laborpraktikum", nur benotet! Beide mit schriftlicher Klausur.

Wer teilnehmen möchte, muss sich ab 19.1.2026, 8h00 über das Campussystem unter Veranstaltungen (nicht unter Prüfungen!) auf die Warteliste setzen. Die endgültige Entscheidung, ob man teilnehmen kann, erfolgt erst 10.2.2026.

Die Teilnehmer und Teilnehmerinnen machen in Gruppen zu 3-5 Personen vier Versuche, jeder ~4 h Dauer mit Themen des Instituts aus diesen Bereichen (keine Auswahl möglich):

Röntgenoptik
UV-Lithographie am Beispiel des Photoresists AZ 4533
Fluidische Komponenten aus Polymerwerkstoffen am Beispiel eines Mischerbauteils
Rasterkraftmikroskopie
3D-Printing
Lichtstreuung an Chrommasken
Heißprägen von Kunststoff-Mikrostrukturen
Grundlagen der SAW-Biosensorik
Nano3D-Drucker - Materialtransfer dünnster Schichten
Electrospinning technology for 3D additive manufacturing
Nuclear magnetic resonance imaging
Introduction to Two-Photon Lithography

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

2143875, SS 2026, 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 14.-18.9.2026 an vier halben Tagen 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 in der Woche nach dem Praktikum, voraussichtlich am 24.9.2026.

Wer teilnehmen möchte, muss sich ab 6.7.2026, 8h00 über das Campussystem unter Veranstaltungen (nicht unter Prüfungen!) auf die Warteliste setzen. Die endgültige Entscheidung, ob man teilnehmen kann, erfolgt erst 31.8.2026.

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

T 6.176 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing			Schell
ST 2026	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 6.177 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-107326 - MINT Elective Module

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
Exams					
WT 25/26	76-T-MACH-110318	Product- and Production-Concepts for modern Automobiles			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 6.178 Module component: Product Lifecycle Management [T-MACH-105147]

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

Part of: M-MACH-107326 - MINT Elective Module

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

Exams			
WT 25/26	76-T-MACH-105147	Product Lifecycle Management	Ovtcharova, Meyer, Rönnau

Assessment
Writen examination 90 min.

Prerequisites
None

Workload
120 hours

T 6.179 Module component: Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components [T-MACH-113575]

Coordinators: Prof. Dr.-Ing. Frederik Zanger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	3

Courses					
ST 2026	2150704	Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components	3 SWS	Practical course / 🗣	Zanger, Frey

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

Assessment
Assessment of another type of examination (graded)

The competence certificate is a project work; alternative test achievement according to § 4 Abs. 2 No. 3 of the SPO. Here, the project work, the milestone-based presentation of the results in presentation form (10 min each) and a final oral examination (15 min) are included in the assessment.

Prerequisites
The following module component may not have started:

- T-MACH-114019 - Additive Fertigung metallischer Bauteile: Designoptimierung und Herstellung
- T-MACH-110983 - Projektpraktikum Additive Fertigung: Entwicklung und Fertigung eines additiven Bauteils
- T-MACH-114624 - Projektpraktikum Additive Fertigung: Designoptimierung und Herstellung metallischer Bauteile
- T-MACH-110960 - Projektpraktikum Additive Fertigung: Entwicklung und Fertigung eines additiven Bauteils

Additional Information
The course is offered in German.

Workload
120 hours

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

V Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components

Practical course (P)
On-Site

2150704, SS 2026, 3 SWS, Language: German, Open in study portal

Content
The course “Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components” combines the fundamentals of powder bed fusion laser beam melting (PBF-LB/M) with a development project in collaboration with an industry-relevant application case.

Students learn the basics of the following topics:

- Influence of various process variables on the component quality of parts manufactured using the PBF-LB/M process
- Preparation and simulation of the PBF-LB/M process
- Manufacturing of additive metal components
- Process monitoring and quality assurance in additive manufacturing
- Topology optimization
- Computer-aided manufacturing (CAM) for machining rework

The topics are demonstrated in practice in various workshops on the individual topics and transferred to the development task in teamwork. Finally, the results of the work are additively manufactured and machined. The results are then presented, reflected upon, and discussed.

Attendance of the course “Additive Fertigung metallischer Bauteile” is recommended.

Learning Outcomes:

Students ...

- can describe the characteristics and areas of application of the additive manufacturing process powder bed fusion of metals (PBF-LB/M).
- can describe and implement the creation of a product along the entire additive process chain (CAD, simulation, construction job preparation, CAM) from the initial idea to production.
- are able to discuss the development process for components that are optimized for additive manufacturing.
- are able to perform topology optimization of a component for manufacturing using additive manufacturing.
- are able to simulate the additive process, compensate for process-related distortion, and determine the ideal alignment on the build platform.
- are able to create the necessary support structures for the additive process and derive a build job file.
- are able to create a CAM model for the machining post-processing of additive components and to machine the component.
- can select suitable powder fractions and process variables for the additive manufacturing of high-quality components based on existing test results.

Workload:

regular attendance: 14 hours
self-study: 106 hours

Organizational issues
Das Praktikum wird erstmals im Sommersemester 2026 angeboten.

Unregelmäßige Termine, siehe Zeitplan auf wbk-Homepage.
Irregular dates, see schedule on the wbk homepage.

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

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

T 6.180 Module component: Quality Management [T-MACH-102107]

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

Part of: M-MACH-107326 - MINT Elective Module

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					
WT 25/26	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 6.181 Module component: Rail System Technology [T-MACH-106424]

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

Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	5

Courses					
WT 25/26	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
ST 2026	2115919	Rail System Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
WT 25/26	76-T-MACH-106424	Rail System Technology			Cichon
ST 2026	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, 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).

V Rail System Technology
2115919, SS 2026, 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, der Termin steht noch nicht fest

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 6.182 Module component: Rail Vehicle Technology [T-MACH-105353]

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

Part of: M-MACH-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	5

Courses					
WT 25/26	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
ST 2026	2115996	Rail Vehicle Technology	2 SWS	Lecture / 🗣	Cichon
Exams					
WT 25/26	76-T-MACH-105353	Rail Vehicle Technology			Cichon
ST 2026	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, 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).

V Rail Vehicle Technology
2115996, SS 2026, 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, der Termin steht noch nicht fest

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

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

T 6.183 Module component: Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society [T-FORUM-113587]

Coordinators:	Dr. Christine Mielke Christine Myglas
Organisation:	General Studies. Forum Science and Society (FORUM)
Part of:	M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

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

Prerequisites

In order to register, it is mandatory that the basic module and the advanced module have been completed and that the grades for the partial performances in the advanced module are available.

Registration as a partial achievement means the issue of a certificate.

T 6.184 Module component: Ressources for the Energy Transition [T-MACH-114855]

Coordinators: Rhea Riegler
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	1

Courses					
WT 25/26	5012092	Ressources for the Energy Transition	2 SWS	Seminar	Riegler
Exams					
ST 2026	76-T-MACH-114855	Ressources for the Energy Transition			

Assessment
Academic achievements in the form of written assignments and/or oral performances.

Prerequisites
none

Additional Information
Registration via HoC, limited to 25 students, lot procedure

Workload
60 hours

T 6.185 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-107326 - MINT Elective Module

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, Mombaur
Exams					
WT 25/26	7500106	Robotics I - Introduction to Robotics			Asfour
ST 2026	7500218	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 6.186 Module component: Robotics II - Humanoid Robotics [T-INFO-114152]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
ST 2026	2400074	Robotics II: Humanoid Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
WT 25/26	7500211	Robotics II: Humanoid Robotics			Asfour
ST 2026	7500086	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 lecture on Robotics I – Introduction to Robotics is recommended

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

V Robotics II: Humanoid Robotics — **Lecture (V) On-Site**
2400074, SS 2026, 2 SWS, Language: English, Open in study portal

Content

This lecture addresses the implementation of complex sensorimotor and cognitive abilities in humanoid robots, with humans serving as inspiration. The lecture begins by addressing the motivation for humanoid robotics.

The history of humanoid robotics and biomechanical models of the human body that inform robot design are covered, along with some mechatronic principles underlying humanoid robot systems.

The first main topic comprehensively addresses grasping and manipulation. After covering fundamentals, the lecture discusses neuroscientific insights and concepts like grasp phases and grasping synergies to reduce control complexity. Taxonomies are presented as structured frameworks for understanding the space of possible constraints in grasping and manipulation. The lecture addresses computational approaches for grasping known, familiar, and unknown objects, covering both classical methods and modern learning-based approaches using deep learning and vision-language-action models.

The second main topic covers learning from demonstration and imitation learning. After introducing the topic, fundamentals are presented including the learning from demonstration cycle. The lecture emphasizes learning task models on both symbolic/ semantic and subsymbolic/sensorimotor levels. While methods for capturing human demonstrations are briefly covered, the focus is on semantic segmentation of human demonstrations and learning of task constraints that capture the task and allow generalization. Movement primitives are presented as efficient representations that allow robots to generalize learned behaviors to new situations.

The lecture concludes with cognitive and AI-based architectures for humanoid robots, discussing state-of-the-art approaches, methods to address the signal-to-symbol gap, and human-inspired memory architectures that enable intelligent robot behavior.

Learning Objectives:

Students can explain the challenges and goals of humanoid robotics research, particularly regarding the implementation of complex sensorimotor and cognitive abilities in humanoid robots. They are familiar with the history of the field and understand how biomechanical models of the human body inform humanoid robot design.

Students have comprehensive knowledge of human and robotic grasping and manipulation. They can analyze human grasping and manipulation strategies, understand taxonomies, and evaluate different computational approaches for grasping and manipulation. They understand the challenges in transferring concepts from human studies to humanoid robots.

Students understand fundamentals of learning from human demonstration and imitation learning. They can explain the learning from demonstration cycle and methods for learning generalized task representation, especially task constraints from demonstrations, and how learned behaviors are reproduced on robots.

Students can describe cognitive and AI-based architectures for humanoid robots, including approaches to address the signal-to-symbol gap and human-inspired memory architectures that enable intelligent robot behavior.

Organizational issues

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Recommendations

Having visited the lectures on *Robotics I – Introduction to Robotics* is recommended.

Workload:

90 h

- approx. 15 * 2 h = 30 h attendance time
- approx. 15 * 2 h = 30 h self-study prior/after the lecture
- approx. 30 h preparation for the exam and exam itself

Literature

Additional literature

Scientific publications on the topic are made available on the lecture website.

T 6.187 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2400067	Robotics III: Sensors and Perception in Robotics	2 SWS	Lecture / 🗣	Asfour, Triebel
Exams					
WT 25/26	7500207	Robotics III - Sensors and Perception in Robotics			Asfour
ST 2026	7500242	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
Having visited the lectures on 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 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
This lecture complements the lecture “Robotics I” and provides a comprehensive overview of sensors and perception methods in robotics. It is divided into two main parts.

The first part introduces fundamental concepts of perception in robotics, including the distinction between sensation and perception within the perception-cognition-action loop. It covers sensor fundamentals, such as sensor characteristics (resolution, range, accuracy, bandwidth), analog-to-digital conversion, and common sensor classification schemes. Proprioceptive sensors for measuring the robot’s internal state are discussed, including encoders (optical, magnetic, absolute, and incremental), force/torque sensors, and inertial measurement units (IMUs). The lecture then covers exteroceptive sensors, including proximity sensors, range sensors (LiDAR, time-of-flight cameras, ultrasonic sensors), visual sensors (monocular, stereo, RGB-D cameras), and tactile sensing technologies (capacitive, resistive, and optical).

The second part focuses on processing and interpreting sensor data. Topics in robot vision include image representation, feature detection and matching, object detection and recognition, semantic segmentation, and corresponding deep learning approaches. Point cloud processing is covered with emphasis on data structures, registration, surface reconstruction, and semantic segmentation. The lecture also addresses perception for manipulation, covering object pose estimation, grasp detection, visual servoing, active vision, and haptic exploration. It concludes with the simultaneous localization and mapping (SLAM) problem, including EKF SLAM, Graph SLAM, and FastSLAM.

Learning Obejctives:

Students can explain the main sensor principles used in robotics and distinguish between proprioceptive sensors (encoders, force/torque sensors, IMUs) and exteroceptive sensors (proximity, range, visual, and tactile sensors). They understand and can characterize sensor properties such as resolution, range, accuracy, and bandwidth, and can explain the principles of analog-to-digital conversion. Students are able to propose, analyze, and justify suitable sensor concepts for specific robotic tasks, taking into account trade-offs between different sensor modalities.

Students can apply fundamental perception methods for robotic applications. This includes robot vision techniques such as feature detection and matching, object detection and recognition, and semantic segmentation, including deep learning-based approaches. They can describe and analyze perception methods for manipulation tasks, including object pose estimation, grasp detection, active vision strategies, and haptic exploration. In addition, students can explain point cloud processing methods for registration and surface reconstruction, as well as principles of simultaneous localization and mapping (SLAM).

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Recommendations
Having visited the lecture *Robotics I – Introduction to Robotics* is recommended.

Workload:
90 h

- approx. 15 * 2 h = 30 h attendance time
- approx. 15 * 2 h = 30 h self-study prior/after the lecture
- approx. 30 h preparation for the exam and exam itself

Literature
Lecture slides will be provided during the course.

Accompanying literature references regarding the individual topics of the lecture will be provided.

T 6.188 Module component: Scientific Computing for Engineers [T-MACH-100532]

Coordinators: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2181738	Scientific computing for Engineers	2 SWS	Lecture / 🗣	Weygand, Gumbsch
WT 25/26	2181739	Exercises for Scientific Computing for Engineers	2 SWS	Practice / 🗣	Weygand
Exams					
WT 25/26	76-T-MACH-100532	Scientific Computing for Engineers			Weygand, Gumbsch

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

Assessment
Written exam (90 minutes)

Prerequisites
The module components can not be combined with "Application of advanced programming languages in mechanical engineering" (T-MACH-105390).

Additional Information
The course is offered in German.

Workload
120 hours

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

V Scientific computing for Engineers
2181738, WS 25/26, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. Introduction: why scientific computing
2. computer architectures
3. Introduction to Unix/Linux
4. Foundations of C++
* progamm organization
* data types, operator, control structures
* dynamic memory allocation
* functions
* class
* OpenMP parallelization
5. numeric /algorithms
* finite differences
* MD simulations: 2nd order differential equations
* algorithms for particle simulations
* solver for linear systems of eqns.

The student can

- apply the programming language C++ for scientific computing in the field of materials science
- adapt programs for use on parallel platforms
- choose suitable numerical methods for the solution of differential equations.

The lecture can not be combined with the lecture "Application of advanced programming languages in mechanical engineering" (2182735).

regular attendance: 22,5 hours
Lab: 22,5 hours (optional)
self-study: 75 hours

written exam 90 minutes

Literature

1. C++: Einführung und professionelle Programmierung; U. Breymann, Hanser Verlag München
2. C++ and object-oriented numeric computing for Scientists and Engineers, Daoqui Yang, Springer Verlag.
3. The C++ Programming Language, Bjarne Stroustrup, Addison-Wesley
4. Die C++ Standardbibliothek, S. Kuhlins und M. Schader, Springer Verlag

Numerik:

1. Numerical recipes in C++ / C / Fortran (90), Cambridge University Press
2. Numerische Mathematik, H.R. Schwarz, Teubner Stuttgart
3. Numerische Simulation in der Moleküldynamik, Griebel, Knapek, Zumbusch, Caglar, Springer Verlag

V **Exercises for Scientific Computing for Engineers**
2181739, WS 25/26, 2 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
Exercises for the different topics of the lecture "Scientific computing for Engineers" (2181738)

regular attendance: 22,5 hours

Organizational issues
Veranstaltungsort (RZ Pool Raum) wird in Vorlesung bekannt gegeben

Literature
Skript zur Vorlesung "Wissenschaftliches Programmieren für Ingenieure" (2181738)

T 6.189 Module component: Scientific Empowerment. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society [T-FORUM-113954]

Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Version
Coursework	2 CP	pass/fail	5

Courses					
ST 2026	1130611	Scientific empowerment. What Do People Do with Science? What Does Science Do with People? A basic seminar on the relation between science and society	2 SWS	Seminar / 🗣	Roessing
Exams					
ST 2026	1200004-M	Scientific Empowerment. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society			Teutsch

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

Assessment
Coursework that must include a presentation (maximum 30 minutes)

Workload
60 hours

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

V Scientific empowerment. What Do People Do with Science? What Does Science Do with People? A basic seminar on the relation between science and society

Seminar (S)
On-Site

1130611, SS 2026, 2 SWS, Language: German, Open in study portal

Content
This seminar is held in German. Please visit the German page to read the course description.

Organizational issues
Anmeldung erforderlich über: https://plus.campus.kit.edu/signmeup/procedures/6081

Literature
Lektüre und Diskussion zum Teil englischsprachiger Literatur

T 6.190 Module component: Scientific Literacy. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society [T-FORUM-113972]

Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Version
Coursework	2 CP	pass/fail	4

Courses					
WT 25/26	1100012	Scientific Literacy. What Do People Do with Science? What Does Science Do with People? A basic Seminar on the Relation between Science and Society	2 SWS	Seminar / 🗣	Roessing
ST 2026	1130613	Scientific Literacy. What Do People Do with Science? What Does Science Do with People? A basic Seminar on the Relation between Science and Society	2 SWS	Seminar / 🗣	Roessing
Exams					
WT 25/26	1200009	Scientific Literacy. What Do People Do with Science? What Does Science Do with People? A basic Seminar on the Relation between Science and Societyon the Relation Between Science and Society			Teutsch
ST 2026	1200001-M	Scientific Literacy. Between “Follow the Science” and “Do Your Own Research” A Basic Seminar on the Relation Between Science and Society			Teutsch

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

Assessment
Coursework that must include a presentation (maximum 30 minutes)

Prerequisites
none

Workload
60 hours

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

V **Scientific Literacy. What Do People Do with Science? What Does Science Do with People? A basic Seminar on the Relation between Science and Society** — **Seminar (S) On-Site**
1100012, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
Science and society share many intersections. Contacts between science and society are not always smooth but often conflict-ridden. This seminar addresses a variety of subjects from the realm of science and society. Among those subjects are:

- Freedom of research – formal and in reality
- Science communication through the media
- Risk communication
- Public opinion concerning science and scientists
- Policy for science: STEM vs. humanities?
- Politics and Science: “Expertocracy”?
- Science and propaganda
- Science and the economy
- Religion and Science

The topics are explored through presentations by the participants and applied to more or less recent societal debates. The discussions will be furthered by readings of selected (and short) texts by all seminar participants.

The goal of the basic seminar is, on the one hand, for you to critically examine the role that the sciences and especially your field of study play in our society. On the other hand, the seminar raises some fundamental questions that should accompany students taking the Supplementary Studies on Science, Technology and Society through the in-depth courses.

2 LP

Organizational issues
registration required via: https://plus.campus.kit.edu/signmeup/procedures/5216

V **Scientific Literacy. What Do People Do with Science? What Does Science Do with People? A basic Seminar on the Relation between Science and Society**
1130613, SS 2026, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Science and society share many intersections. Contacts between science and society are not always smooth but often conflict-ridden. This seminar addresses a variety of subjects from the realm of science and society. Among those subjects are:

- Freedom of research – formal and in reality
- Science communication through the media
- Risk communication
- Public opinion concerning science and scientists
- Policy for science: STEM vs. humanities?
- Politics and Science: “Expertocracy”?
- Science and propaganda
- Science and the economy
- Religion and Science

The topics are explored through presentations by the participants and applied to more or less recent societal debates. The discussions will be furthered by readings of selected (and short) texts by all seminar participants.

The goal of the basic seminar is, on the one hand, for you to critically examine the role that the sciences and especially your field of study play in our society. On the other hand, the seminar raises some fundamental questions that should accompany students taking the Supplementary Studies on Science, Technology and Society through the in-depth courses.

2 LP

Organizational issues
registration required via: https://plus.campus.kit.edu/signmeup/procedures/6080

T 6.191 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Graded [T-MACH-113322]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107330 - Key Competencies

Type	Credits	Grading	Term offered	Version
Examination of another type	1 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 Wissenschaft und Gesellschaft (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 6.192 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Graded [T-MACH-112687]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107330 - Key Competencies

Type	Credits	Grading	Term offered	Version
Examination of another type	1 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 Wissenschaft und Gesellschaft (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 6.193 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded [T-MACH-112686]

Coordinators: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107330 - Key Competencies

Type	Credits	Grading	Term offered	Version
Coursework	1 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 Wissenschaft und Gesellschaft (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 6.194 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded [T-MACH-113321]

Coordinators: Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107330 - Key Competencies

Type	Credits	Grading	Term offered	Version
Coursework	1 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 Wissenschaft und Gesellschaft (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 6.195 Module component: Seminar "Materials Modelling" [T-MACH-107660]

Coordinators: Prof. Dr. Britta Nestler
Prof.PD Dr.Ing. Katrin Schulz
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	3

Courses					
WT 25/26	2183717	Seminar "Materials Modelling"	4 SWS	Seminar / Blended (On-Site/Online)	Gumbsch, Nestler, Böhlke, August, Schulz, Prahs, Weygand
ST 2026	2183717	Seminar "Materials Modeling"	4 SWS	Seminar / On-Site	Nestler, Gumbsch, Böhlke, Weygand
Exams					
WT 25/26	76-T-MACH-107660	Seminar "Materials Modelling"			Gumbsch, Nestler, Böhlke, Weygand, Schulz, Selzer, August, Koeppe

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

Assessment
The control of success is a project work; examination of another type according to article 4 paragraph 2 number 3 of the studies and examination regulations. The project thesis (30-40 pages) and the final presentation (about 30 min) enter the final grading.

Prerequisites
T-MACH-113814 – Seminar Materials Simulation has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-113814 - Seminar Materials Simulation must not have been started.

Recommendations
preliminary knowlegde in mathematics, physics 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 Seminar "Materials Modelling"

2183717, WS 25/26, 4 SWS, Language: German/English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
The topic of the seminar has to be related to the major field "Computational Materials Science" and has to refer to subject-specific or interdisciplinary problems relating to latest research activities at the involved institutes.

The student

- can independently elaborate a scientific problem in the field of "Computational Materials Science".
- can accomplish a scientific literature search.
- can choose suitable methods as well as techniques and use or refine them to solve his problem.
- can compare and evaluate his/her results with the latest state of the art.
- can present his/her scientific results both written and oral.

preliminary knowlegde in mathematics, physics and materials science recommende

regular attendance: 45 hours

self-study: 195 hours

Grading based on a written seminar paper (60%) of 30-40 pages and an oral presentation (40%) of 30 min with following discussion.

Organizational issues
Weitere Informationen in den Vorlesungen und Sprechstunden der Dozenten/in!

V **Seminar "Materials Modeling"**
2183717, SS 2026, 4 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
The topic of the seminar has to be related to the major field "Computational Materials Science" and has to refer to subject-specific or interdisciplinary problems relating to latest research activities at the involved institutes.

The student

- can independently elaborate a scientific problem in the field of "Computational Materials Science".
- can accomplish a scientific literature search.
- can choose suitable methods as well as techniques and use or refine them to solve his problem.
- can compare and evaluate his/her results with the latest state of the art.
- can present his/her scientific results both written and oral.

preliminary knowlegde in mathematics, physics and materials science recommende

regular attendance: 45 hours

self-study: 195 hours

Grading based on a written seminar paper (60%) of 30-40 pages and an oral presentation (40%) of 30 min with following discussion.

Organizational issues
Weitere Informationen in den Vorlesungen und Sprechstunden der Dozenten/innen!

T 6.196 Module component: Seminar Materials Simulation [T-MACH-113814]

Coordinators: Prof. Dr. Britta Nestler
Prof.PD Dr.Ing. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	1

Courses					
WT 25/26	2183717	Seminar "Materials Modelling"	4 SWS	Seminar / 🧩	Gumbsch, Nestler, Böhlke, August, Schulz, Prahs, Weygand
Exams					
WT 25/26	76-T-MACH-113814	Seminar Materials Simulation			Nestler, Gumbsch, Böhlke, Weygand, Schulz, Selzer, August

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

Assessment
The control of success is a project work; examination of another type according to article 4 paragraph 2 number 3 of the studies and examination regulations. The project thesis (30-40 pages) and the final presentation (about 30 min) enter the final grading.

Prerequisites
T-MACH-107660 – Seminar Werkstoffsimulation has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-107660 - Seminar "Materials Modelling" must not have been started.

Recommendations
preliminary knowlegde in mathematics, physics and materials science

Additional Information
The course is offered in English.

Workload
240 hours

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

V Seminar "Materials Modelling"

2183717, WS 25/26, 4 SWS, Language: German/English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
The topic of the seminar has to be related to the major field "Computational Materials Science" and has to refer to subject-specific or interdisciplinary problems relating to latest research activities at the involved institutes.

The student

- can independently elaborate a scientific problem in the field of "Computational Materials Science".
- can accomplish a scientific literature search.
- can choose suitable methods as well as techniques and use or refine them to solve his problem.
- can compare and evaluate his/her results with the latest state of the art.
- can present his/her scientific results both written and oral.

preliminary knowlegde in mathematics, physics and materials science recommende

regular attendance: 45 hours

self-study: 195 hours

Grading based on a written seminar paper (60%) of 30-40 pages and an oral presentation (40%) of 30 min with following discussion.

Organizational issues
Weitere Informationen in den Vorlesungen und Sprechstunden der Dozenten/in!

T 6.197 Module component: Sensor Systems [T-ETIT-100709]

Coordinators: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

T 6.198 Module component: Sensors [T-ETIT-101911]

Coordinators: TT-Prof. Dr. Johanna Schröder
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module
M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2026	2304231	Sensors	2 SWS	Lecture /	Schröder
Exams					
WT 25/26	7304231	Sensors			Menesklou
ST 2026	7304231	Sensors			Menesklou, Schröder

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

Assessment
Success is assessed in the form of a written examination lasting 2 hours.

Prerequisites
none

Recommendations
Basic knowledge of materials science (e.g. lecture "Passive components") is helpful.

T 6.199 Module component: Signal Processing Methods [T-ETIT-113837]

Coordinators: Prof. Dr.-Ing. Sander Wahls
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107326 - MINT Elective Module

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					
WT 25/26	7302113	Signal Processing Methods			Wahls

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

Assessment
Written exam, approx. 120 minutes.
The module grade is the grade of the written exam.

Prerequisites
none

Recommendations
Familiarity with signals and systems (in particular, Fourier transforms) and probability theory at the Bachelor level is assumed.

T 6.200 Module component: Simulation of Nanoscale Systems, without Seminar [T-PHYS-102504]

Coordinators: Prof. Dr. Wolfgang Wenzel
Organisation: KIT Department of Physics
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Prerequisites
none

T 6.201 Module component: Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures [T-MACH-105971]

Coordinators: Prof. Dr.-Ing. Luise Kärger

Organisation: KIT Department of Mechanical Engineering
Lightweight Design

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2114107	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures	2 SWS	Lecture / Practice / 🗣	Kärger

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

Assessment
oral exam, approx. 20 minutes

Prerequisites
T-MACH-114003 and T-MACH-114004 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 Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures

Lecture / Practice (VÜ)
On-Site

2114107, SS 2026, 2 SWS, Language: German, Open in study portal

Content

The lecture deals with methods for the calculation of FRP components with continuous fiber reinforcement and provides the necessary understanding of materials and processes. The material behavior of fiber composites is largely determined by the fiber structure. This must be suitably modeled in the single layer and in the multilayer composite in order to be able to reliably predict the deformation and damage behavior of FRP components. In the case of curved components, the fiber structure is only created during the manufacturing process, specifically during the forming (draping) of the two-dimensional semi-finished products into a three-dimensional structure (preform). In addition, there is the mold filling process, in which the preform is infiltrated with a reactive resin system, as well as the curing process, which can lead to distortion and residual stresses. In addition to the simulation of structural behavior, process simulation is therefore an essential building block for the holistic development of fiber composite components. The main contents are:

- Virtual Process Chain
- Draping simulation: draping behavior of textiles
  draping process, kinematic draping simulation, FE draping simulation
- Molding simulation: Principles of fluid mechanics, viscosity and permeability, molding simulation within the CAE chain
- Curing simulation and distortion: process of crosslinking, resin kinetics, thermomechanics, internal stresses, part distortion
- Structural simulation: Modelling of multilayer laminate,
  influence of manufacturing effects

Study goals:

The students understand that the microstructure of fibre reinforces plastics (FRP) and the resulting material behavior is mainly influenced by the manufacturing process. They know the simulation steps needed to virtually describe the process chain of RTM (resin transfer molding) parts. They are able to explain the principal mechanical processes of draping, molding and curing and can name their influences on the structural behavior.

Workload:

lectures: 21h, preparation of examination: 63h

Literature

Altenbach, J. Altenbach, and R. Rikards: Einführung in die Mechanik der Laminat- und Sandwichtragwerke. Deutscher Verlag für Grundstoffindustrie, Stuttgart, 1. edition, 1996.

Altenbach, J. Altenbach, W. Kissing; Mechanics of Composite Structural Elements . ISBN 978-3-642-07411-0 Springer-Verlag Berlin Heidelberg, 2004.

Barbero, J.: Introduction to Composite Materials Design. CRC Press, Boca Raton, FL, 2. edition, 2011.

Bickerton, S.; Sozer, E.M. Simacek, P. and Advani, S.G.: “Fabric structure and mold curvature effects on preform permeability and mold filling in the RTM process. Part II. Predictions and comparisons with experiments”. Composites Part A 31: 439–458, 2000.

Henning, F.; Moeller, E.: Handbuch Leichtbau: Methoden, Werkstoffe, Fertigung. Carl Hanser Verlag GmbH & Co. KG, 2011.

Kärger, L.; Bernath, A.; Fritz, F.; Galkin, S.; Magagnato, D.; Oeckerath, A.; Schön, A.; Henning, F.: Development and validation of a CAE chain for unidirectional fibre reinforced composite components. Composite Structures 132: 350–358, 2015.

Puck A: Festigkeitsanalyse von Faser-Matrix-Laminaten, Modelle für die Praxis. Carl Hanser Verlag, München, Wien, 1. edition, 1996.

Schürmann H: Konstruieren mit Faserverbundwerkstoffen. ISBN 3-540-40283-7 . Springer Verlag, 2005.

Stephen W. Tsai and J. Daniel D. Melo: Composite Materials Design and Testing. Composites Design Group, 978-0-9860845-1-5 Stanford University , 2015.

6.202 Module component: Single-Photon Detectors [T-ETIT-108390]

Coordinators: Dr. Konstantin Ilin
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2312680	Single-Photon Detectors	2 SWS	Lecture / 🗣	Ilin
WT 25/26	2312694	Tutorial for 2312680 Single-Photon Detectors	1 SWS	Practice / 🗣	Ilin
Exams					
WT 25/26	7312680	Single-Photon Detectors			Ilin
ST 2026	7312680	Single-Photon Detectors			Ilin

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

Assessment
Success controll takes place in form of an overall oral examination lasting approx. 20 minutes.

Prerequisites
none

T 6.203 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-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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					
WT 25/26	7313745	Solar Energy			Richards, Paetzold
ST 2026	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 6.204 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-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	6

Courses					
WT 25/26	2189400	Solar Thermal Energy Systems	2 SWS	Lecture / 🗣	Dagan
Exams					
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 6.205 Module component: Solid-State Optics, without Exercises [T-PHYS-104773]

Coordinators: PD Dr. Michael Hetterich
Organisation: KIT Department of Physics
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	4020011	Solid-State-Optics	4 SWS	Lecture / 🗣	Hetterich
Exams					
WT 25/26	7800104	Solid-State Optics, without Exercises			Hetterich

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

Prerequisites
none

T 6.206 Module component: Structural and Phase Analysis [T-MACH-102170]

Coordinators: Dr.-Ing. Susanne Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Exams			
WT 25/26	76-T-MACH-102170	Structural and Phase Analysis	Wagner

Assessment
Oral examination

Prerequisites
none

T 6.207 Module component: Superconducting Magnet Technology [T-ETIT-113440]

Coordinators: Prof. Dr. Tabea Arndt
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2312698	Superconducting Magnet Technology	3 SWS	Lecture / Practice / Blended	Arndt
Exams					
WT 25/26	7300031	Superconducting Magnet Technology			Arndt
ST 2026	7300001	Superconducting Magnet Technology			Arndt

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

Assessment
The examination takes place in form of an oral exam (abt. 30 minutes).

Two timeslots (weeks) for examination dates will be announced (usually near end of lecture period & end of semester).

The module grade is the grade of the oral exam.

Prerequisites
none

T 6.208 Module component: Superconducting Materials Lab [T-ETIT-114730]

Coordinators: Dr. Jens Hänisch
Prof. Dr. Bernhard Holzapfel

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each summer term	1

Courses					
ST 2026	2312696	Superconducting Materials Part II	2 SWS	Practical course / 🗣	Holzapfel, Hänisch
Exams					
WT 25/26	7312696	Superconducting Materials			Holzapfel, Hänisch

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

Assessment
The success control takes place in the form of other types of examination. It consists of a written protocol (approx. 40 pages).

Prerequisites
T-ETIT-111239 - Superconductivity for Engineers must not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-111239 - Superconductivity for Engineers must not have been started.

Recommendations
It is recommanded to pass the lecture (part I) before the lab (part II).

T 6.209 Module component: Superconducting Materials Lecture [T-ETIT-114729]

Coordinators: Dr. Jens Hänisch
Prof. Dr. Bernhard Holzapfel

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2312717	Superconducting Materials Part I	2 SWS	Lecture / 🗣	Holzapfel, Hänisch
Exams					
WT 25/26	7312696	Superconducting Materials			Holzapfel, Hänisch

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

Assessment
The Success control takes place in the form of an oral examination lasting approx. 30 minutes.

Prerequisites
T-ETIT-111239 - Superconductivity for Engineers must not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-111239 - Superconductivity for Engineers must not have been started.

Recommendations
It is recommanded to pass the lecture (part I) before the lab (part II).

T 6.210 Module component: Superconducting Nanowire Detectors [T-ETIT-111236]

Coordinators: Dr. Konstantin Ilin
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
ST 2026	2312671	Superconducting Nanowire Detectors	2 SWS	Lecture / 🗣	Ilin
ST 2026	2312673	Practice to 2312671 Superconducting Nanowire Detectors	1 SWS	Practice / 🗣	Ilin
Exams					
ST 2026	7312671	Superconducting Nanowire Detectors			Ilin

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

Assessment
Oral Exam (approx. 20 min.)

Prerequisites
none

T 6.211 Module component: Superconducting Power Systems [T-ETIT-113439]

Coordinators: Prof. Dr.-Ing. Mathias Noe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

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

Courses					
WT 25/26	2314011	Superconducting Power Systems	3 SWS	Lecture / Practice / 🗣	Noe
Exams					
WT 25/26	7300034	Superconducting Power Systems			Noe

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

Assessment
The examination takes place in form of an oral exam (abt. 45 minutes).

The module grade is the grade of the oral exam.

Prerequisites
none

T 6.212 Module component: Superconductivity for Engineers [T-ETIT-111239]

Coordinators: Prof. Dr. Bernhard Holzapfel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Each winter term	1 semesters	4

Courses					
WT 25/26	2312708	Superconductivity for Engineers	3 SWS	Lecture / 🗣	Kempf, Holzapfel
WT 25/26	2312709	Exercise for 2312708 Superconductivity for Engineers	1 SWS	Practice / 🗣	Hänisch, Arldt
Exams					
WT 25/26	7312708	Superconductivity for Engineers			Kempf
ST 2026	7312691	Superconductivity for Engineers			Kempf, Holzapfel

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

Assessment
The assessment of success takes place in the form of a written examination lasting 120min.

The module grade is the grade of the written examination.

Prerequisites
T-ETIT-114729 - Superconducting Materials Lecture must not been started.

T-ETIT-114730 - Superconducting Materials Lab must not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-ETIT-114729 - Superconducting Materials Lecture must not have been started.
2. The module component T-ETIT-114730 - Superconducting Materials Lab must not have been started.

T 6.213 Module component: Superhard Thin Film Materials [T-MACH-102103]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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					
WT 25/26	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
2177618, 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

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 6.214 Module component: Superhard Thin Film Materials [T-MACH-111257]

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

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2194729	Superhard Thin Film Materials	2 SWS	Lecture / 🗣	Ulrich
Exams					
WT 25/26	76-T-MACH-111257	Superhard Thin Film Materials			Ulrich

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

Assessment
oral examination (ca. 30 Minuten)

Prerequisites
none

Recommendations
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 Superhard Thin Film Materials

2194729, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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

Teaching Content:

Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic 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
The block course takes place in the following period:

15.04.2026: 14:00 -19:00 and

16./17.04.2026: each time from 8:00-19:00;

Location: KIT-CN, Building 681, Room 214

Binding registration until 13.04.2026 at sven.ulrich@kit.edu.

After registration, you will receive the link to the lecture by e-mail on 14.04.2026 in case of an online event.

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 6.215 Module component: Technology Assessment and its Normative Basis [T-MACH-113884]

Coordinators: Prof. Dr. Dr. Rafaela Hillerbrand
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106939 - Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each winter term	1 semesters	3

Courses					
WT 25/26	5000057	Aufbaumodul: Technikfolgenabschätzung und Normativität	2 SWS	Block	Hillerbrand
Exams					
WT 25/26	7400608	Normative Aspects of Technology Assessment - Limits and Possibilities of a (Prospective) Technology Assessment - Advanced Seminar			Hillerbrand

Assessment
Coursework in the form of written assignments and/or oral performances.

Prerequisites
none

Workload
60 hours

T 6.216 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-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
ST 2026	2174579	Technology of steel components	2 SWS	Lecture / 🗣	Schulze
Exams					
WT 25/26	76-T-MACH-105362	Technology of Steel Components			Schulze
ST 2026	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 2026, 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 6.217 Module component: The ABC of DFT [T-PHYS-105960]

Coordinators: Prof. Dr. Carsten Rockstuhl
Prof. Dr. Wolfgang Wenzel

Organisation: KIT Department of Physics

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2026	4023151	The ABC of DFT	2 SWS	Lecture / 🗣	Krstic, Wenzel, Holzer
ST 2026	4023152	Exercises to The ABC of DFT	1 SWS	Practice / 🗣	Wenzel, Holzer

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

T 6.218 Module component: Theoretical Quantum Optics [T-PHYS-110303]

Coordinators: Prof. Dr. Anja Metelmann
Prof. Dr. Carsten Rockstuhl

Organisation: KIT Department of Physics

Part of: M-MACH-107561 - Functional Materials (20CP)
M-MACH-107576 - Functional Materials (40CP)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	2

Courses					
WT 25/26	4023011	Theoretical Quantum Optics	2 SWS	Lecture / 🗣	Rockstuhl
WT 25/26	4023012	Exercises to Theoretical Quantum Optics	1 SWS	Practice / 🗣	Rockstuhl, Poleva, Ustimenko
Exams					
WT 25/26	7800096	Theoretical Quantum Optics			Rockstuhl, Metelmann

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

T 6.219 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-107326 - MINT Elective Module

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	3

Exams			
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
ST 2026	76-T-MACH-105363	Thermal Turbomachines I	Bauer
ST 2026	76-T-Mach-105363-Wdh	Thermal Turbomachines I (for repeater)	Bauer

Assessment
oral exam, duration 30 min.

Prerequisites
none

Workload
180 hours

T 6.220 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-107326 - MINT Elective Module

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

Courses					
ST 2026	2170477	Tutorial - Thermal Turbomachines II	2 SWS	Practice / 🗣	Bauer, Mitarbeiter
ST 2026	2170553	Thermal Turbomachines II	3 SWS	Lecture / 🗣	Bauer
Exams					
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
ST 2026	76-T-MACH-105364	Thermal Turbomachines II			Bauer
ST 2026	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

2170553, SS 2026, 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 6.221 Module component: Thermodynamic and Kinetic Fundamentals of Material Science [T-MACH-114532]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107324 - Thermodynamics and Kinetics

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

Courses					
WT 25/26	2193020	Thermodynamic and Kinetic Fundamentals of Material Science	2 SWS	Lecture / On-Site	Gorr, Seifert
Exams					
WT 25/26	76-T-MACH-114532	Thermodynamic and Kinetic Fundamentals of Material Science			Gorr, Seifert
ST 2026	76-T-MACH-114532	Thermodynamic and Kinetic Fundamentals of Material Science			Gorr, Seifert

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

Assessment
Oral exam (about 30 min)

Prerequisites
The successful participation in T-MACH-114534 – Übungen zu Thermodynamischen und Kinetischen Grundlagen der Materialwissenschaft is the condition for the admittance to the oral exam in Thermodynamische und Kinetische Grundlagen der Materialwissenschaft.

T-MACH-114535 – Exercises for Thermodynamic and Kinetic Fundamentals of Material Science has not been started.

T-MACH-114533 – Thermodynamic and Kinetic Fundamentals of Material Science has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114535 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.
2. The module component T-MACH-114533 - Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.
3. The module component T-MACH-114534 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must have been passed.

Additional Information
The course is offered in German.

Workload
150 hours

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

V Thermodynamic and Kinetic Fundamentals of Material Science

Lecture (V)
On-Site

2193020, WS 25/26, 2 SWS, Language: German, Open in study portal

Content

1. Binary phase diagrams
2. Fundamental ternary phase diagrams

- Invariant ternary reactions
- Microstructural development in ternary systems
- Influence of intermetallic phases

3. Thermodynamics of solution phases

- Enthalpy, entropy, Gibbs free energy, chemical potentials

4. Modeling and calculation of phase diagrams
5. Diffusion mechanisms and Fick’s laws
6. Chemical potential as the driving force for diffusion
7. Particle nucleation and growth
8. Kirkendall effect

Literature

- B. Predel, M. Hoch, M. Pool:
Phase Diagrams and Heterogeneous Equilibria: A Practical Introduction,
Springer, Berlin, Heidelberg (2010)
- D. R. F. West, N. Saunders: Ternary Phase Diagrams in Materials Science,
3rd edition, CRC Press (2017)
- A. Paul, T. Laurila, V. Vuorinen, S. Divinski, Thermodynamics, diffusion and the Kirkendall effect in solids, Springer International Publishing Switzerland, 2014; avaliable as e-book
- D. Gupta, Diffusion processes in advanced technological materials,William Andrew, Inc, 2005; avaliable as e-book

T 6.222 Module component: Thermodynamic and Kinetic Fundamentals of Material Science [T-MACH-114533]

Coordinators: Prof. Dr.-Ing. Bronislava Gorr
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107324 - Thermodynamics and Kinetics

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

Courses					
ST 2026	2194730	Thermodynamic and Kinetic Fundamentals of Material Science	2 SWS	Lecture / 🗣	Gorr, Seifert

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

Assessment
Oral exam (about 30 min)

Prerequisites
The successful participation in T-MACH-114535 – Exercises for Thermodynamic and Kinetic Fundamentals of Material Science is the condition for the admittance to the oral exam in Thermodynamische und Kinetische Grundlagen der Materialwissenschaft.

T-MACH-114534 – Übungen zu Thermodynamischen und Kinetischen Grundlagen der Materialwissenschaft has not been started.

T-MACH-114532 – Thermodynamische und Kinetische Grundlagen der Materialwissenschaft has not been started.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114535 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must have been passed.
2. The module component T-MACH-114534 - Exercises for Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.
3. The module component T-MACH-114532 - Thermodynamic and Kinetic Fundamentals of Material Science must not have been started.

Additional Information
The course is offered in English.

Workload
150 hours

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

V Thermodynamic and Kinetic Fundamentals of Material Science
2194730, SS 2026, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
1. Binary phase diagrams
2. Fundamental ternary phase diagrams
- Invariant ternary reactions
- Microstructural development in ternary systems
- Influence of intermetallic phases
3. Thermodynamics of solution phases
- Enthalpy, entropy, Gibbs free energy, chemical potentials
4. Modeling and calculation of phase diagrams
5. Diffusion mechanisms and Fick's laws
6. Chemical potential as the driving force for diffusion
7. Particle nucleation and growth
8. Kirkendall effect

Literature

- B. Predel, M. Hoch, M. Pool:
Phase Diagrams and Heterogeneous Equilibria: A Practical Introduction,
Springer, Berlin, Heidelberg (2010)
- D. R. F. West, N. Saunders: Ternary Phase Diagrams in Materials Science,
3rd edition, CRC Press (2017)
- A. Paul, T. Laurila, V. Vuorinen, S. Divinski, Thermodynamics, diffusion and the Kirkendall effect in solids, Springer International Publishing Switzerland, 2014; avaliable as e-book
- D. Gupta, Diffusion processes in advanced technological materials,William Andrew, Inc, 2005; avaliable as e-book

T 6.223 Module component: Thermophysics of Advanced Materials [T-MACH-111459]

Coordinators: Dr. Dmitry Sergeev
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Courses					
WT 25/26	2193051	Thermophysics of Advanced Materials	2 SWS	Lecture /	Sergeev
ST 2026	2193051	Thermophysics of Advanced Materials	2 SWS	Lecture /	Sergeev

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

Assessment
oral examination (ca. 30 Minuten)

Prerequisites
none

Recommendations

- Knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (with exercises)
- Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (with exercises)

Additional Information
The course is offered in English.

Workload
120 hours

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

V Thermophysics of Advanced Materials

2193051, WS 25/26, 2 SWS, Language: English, Open in study portal

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

Content

- Introduction to Thermophysics
- Thermophysical properties of thermal storage materials
- Properties of pure compounds (solid, liquid and gas phase)
- Binary, ternary and multicomponent systems and their phase diagrams
- Experimental methods for determination of thermophysical properties
    - Thermal stability, evaporation and sublimation processes, and thermodynamic properties of the gas phase (thermogravimetry and Knudsen effusion mass spectrometry)
    - Phase transition temperatures and phase diagrams (differential thermal analysis and high temperature X-ray diffraction)
    - Heat capacity, phase transition enthalpies, formation enthalpies, mixing enthalpies (dynamic difference and drop calorimetry)
    - Thermal expansion (dilatometry and high temperature X-ray diffraction)
    - Thermal conductivity (laser flash analysis etc.)
- Thermodynamic databases and software
- Thermodynamic modelling and calculations according to Calphad method using FactSage

To provide a basic understanding of experimental measurement methods for studying binary and ternary phase diagrams and determining thermophysical properties. Furthermore, the participants will learn about different types of thermal energy storage and their application areas, as well as how to perform thermodynamic calculations for optimization and selection of storage materials using FactSage.

regular attendance: 22 hours

self-study: 98 hours

Recommendations:

- Knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (with exercises)
- Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (with exercises)

oral examination (about 30 min)

Organizational issues
The lecture will take place in presence or online as follows:

31.10.25

07.11.25

14.11.25

21.11.25

28.11.25

05.12.25

12.12.25

19.12.25

You will be informed about the lecture link (Zoom) in ILIAS.

Literature
Stølen S., Grande T., Chemical Thermodynamics of Materials: Macroscopic and Microscopic Aspects, John Wiley & Sons, Chichester, 2004

Sprackling M., Thermal physics, Macmillan Education LTD, Hampshire and London, 1991

Tong C., Introduction to Materials for Advanced Energy Systems, Springer, Cham, 2019

Hemminger W.F., Cammenga, H.K.: Methoden der Thermischen Analyse, Springer, Berlin Heidelberg, 1989

Sorai M., Comprehensive Handbook of Calorimetry and Thermal Analysis, John Wiley & Sons, Chichester, 2004

Lukas, H.L., Fries, S.G., Sundman, B.: Computational Thermodynamics: The Calphad Method, Cambridge University Press, New York, 2007

V **Thermophysics of Advanced Materials**
2193051, SS 2026, 2 SWS, Language: English, Open in study portal

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

Content

- Introduction to Thermophysics
- Thermophysical properties of thermal storage materials
- Properties of pure compounds (solid, liquid and gas phase)
- Binary, ternary and multicomponent systems and their phase diagrams
- Experimental methods for determination of thermophysical properties
  - Thermal stability, evaporation and sublimation processes, and thermodynamic properties of the gas phase (thermogravimetry and Knudsen effusion mass spectrometry)
  - Phase transition temperatures and phase diagrams (differential thermal analysis and high temperature X-ray diffraction)
  - Heat capacity, phase transition enthalpies, formation enthalpies, mixing enthalpies (dynamic difference and drop calorimetry)
  - Thermal expansion (dilatometry and high temperature X-ray diffraction)
  - Thermal conductivity (laser flash analysis etc.)
- Thermodynamic databases and software
- Thermodynamic modelling and calculations according to Calphad method using FactSage

To provide a basic understanding of experimental measurement methods for studying binary and ternary phase diagrams and determining thermophysical properties. Furthermore, the participants will learn about different types of thermal energy storage and their application areas, as well as how to perform thermodynamic calculations for optimization and selection of storage materials using FactSage.

regular attendance: 22 hours

self-study: 98 hours

Recommendations:

- Knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (with exercises)
- Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (with exercises)

oral examination (about 30 min)

Organizational issues

The lecture will take place in presence or online as follows:

1) 24.04.2026: Presence

2) 08.05.2026: Online

3) 15.05.2026: Online

4) 22.05.2026: Presence

5) 05.06.2026: Online

6) 12.06.2026: Online

7) 19.06.2026: Präsenz

You will be informed about the lecture link (Zoom) in ILIAS.

Literature

Stølen S., Grande T., Chemical Thermodynamics of Materials: Macroscopic and Microscopic Aspects, John Wiley & Sons, Chichester, 2004

Sprackling M., Thermal physics, Macmillan Education LTD, Hampshire and London, 1991

Tong C., Introduction to Materials for Advanced Energy Systems, Springer, Cham, 2019

Hemminger W.F., Cammenga, H.K.: Methoden der Thermischen Analyse, Springer, Berlin Heidelberg, 1989

Sorai M., Comprehensive Handbook of Calorimetry and Thermal Analysis, John Wiley & Sons, Chichester, 2004

Lukas, H.L., Fries, S.G., Sundman, B.: Computational Thermodynamics: The Calphad Method, Cambridge University Press, New York, 2007

T 6.224 Module component: Thin Films – Structure, Thermodynamics, Applications in Energy Technologies [T-MACH-114014]

Coordinators: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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

Exams			
ST 2026	76-T-MACH-114014	Thin Films – Structure, Thermodynamics, Applications in Energy Technologies	Wagner

Assessment
oral exam, about 25 minutes

Prerequisites
none

Additional Information
The course is offered in English.

Workload
120 hours

T 6.225 Module component: Transport Economics [T-WIWI-114119]

Coordinators: Prof. Dr. Kay Mitusch
Dr. Eckhard Szimba

Organisation: KIT Department of Business and Economics

Part of: M-MACH-106939 - Technology and Society

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

Assessment
Success is assessed in the form of an ungraded written examination (60 min.) during the lecture-free period of the semester. The examination is offered every semester and can be repeated at any regular examination date.

Workload
120 hours

T 6.226 Module component: Tribology [T-MACH-114853]

Coordinators: Prof. Dr. Martin Dienwiebel
Prof. Dr.-Ing. Matthias Scherge

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107326 - MINT Elective Module

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

Courses					
WT 25/26	2181114	Tribology	5 SWS	Lecture / Practice / 🗣	Dienwiebel, Scherge
Exams					
WT 25/26	76-T-MACH-114853	Tribology (new, MACH, PO 2025)			Dienwiebel
ST 2026	76-T-MACH-114853	Tribology (new, MACH, PO 2025)			Dienwiebel

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

Assessment
oral examination (approx. 40 min)

no tools or reference materials

Prerequisites
Admission to the exam only with successful completion of the exercises [T-MACH-114854]

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-MACH-114854 - Exercices - Tribology must have been passed.

Recommendations
preliminary knowlegde in mathematics, mechanics and materials science

Additional Information
The course is offered in German.

Workload
180 hours

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 6.227 Module component: Tutorial Computational Elasticity [T-MACH-114529]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
WT 25/26	2161147	Tutorial Computational Elasticity	2 SWS	Practice / 🗣	Hille, Speichinger, Langhoff
Exams					
WT 25/26	76-T-MACH-114529	Tutorial Computational Elasticity			Böhlke, Langhoff

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

Assessment
Successful solution of the homework sheets. Details are announced during the first lecture "Computational Elasticity".

Recommendations
see course "Computational Elasticity"

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description "Computational Elasticity"

Workload
30 hours

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

V Tutorial Computational Elasticity

2161147, WS 25/26, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Please refer to the course "Computational Elasticity".

Organizational issues
In Abstimmung mit den Teilnehmenden ist auch Deutsch als Sprache der Lehrveranstaltung möglich. Weitere Informationen werden in der ersten Vorlesung gegeben.

Literature
Siehe Vorlesung "Computational Elasticity" / please refer to course "Computational Elasticity".

T 6.228 Module component: Tutorial Computational Inelasticity [T-MACH-114530]

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

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2162297	Tutorial Computational Inelasticity	2 SWS	Practice / 🗣	Gisy, Speichinger, Böhlke, Langhoff

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

Assessment
Successful solution of the homework sheets. Details are announced during the first lecture "Computational Inelasticity".

Recommendations
see course "Computational Inlasticity"

Additional Information
The corresponding course is offered in English. Further Information can be found in the course description "Computational Inelasticity"

Workload
30 hours

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

V Tutorial Computational Inelasticity

2162297, SS 2026, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Computational Inelasticity"

Organizational issues
Siehe Vorlesung "Computational Inelasticity" / please refer to course "Computational Inelasticity".

In Abstimmung mit den Teilnehmenden kann die Lehrveranstaltung auch in deutscher Sprache stattfinden.

Literature
Siehe Vorlesung "Computational Inelasticity" / please refer to course "Computational Inelasticity".

T 6.229 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Version
Coursework	1 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	2162257	Tutorial Introduction to the Finite Element Method	1 SWS	Practice / 🗣	Lauff, Klein, Langhoff, Böhlke
Exams					
WT 25/26	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, 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 6.230 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-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

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

Courses					
ST 2026	2162281	Tutorial Mathematical Methods in Micromechanics	1 SWS	Practice / 🗣	Speichinger, 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 2026, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Mathematical Methods in Micromechanics"

T 6.231 Module component: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]

Coordinators: Prof. Dr.-Ing. Thomas Böhlke
Organisation:
Part of: M-MACH-107559 - Computational Materials Science (20CP)
M-MACH-107575 - Computational Materials Science (40CP)

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	2

Courses					
ST 2026	2162345	Tutorial in Nonlinear Continuum Mechanics	2 SWS	Practice / 🗣	Hille, Klein, Böhlke
Exams					
WT 25/26	76-T-MACH-111027	Tutorial Nonlinear Continuum Mechanics			Böhlke

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 2026, 2 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
see lecture "Nonlinear Continuum Mechanics"

Organizational issues
Siehe Vorlesung "Nonlinear Continuum Mechanics" / please refer to course "Nonlinear Continuum Mechanics"

Mit Zustimmung aller Teilnehmenden kann die Lehrveranstaltung auch auf Deutsch gehalten werden.

Literature
siehe Vorlesung "Nonlinear Continuum Mechanics"

T 6.232 Module component: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

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

Part of: Lightweight Design
M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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 / Blended	Henning
Exams					
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 6.233 Module component: Welding Technology [T-MACH-105170]

Coordinators: Dr.-Ing. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-107562 - Structural Materials (20CP)
M-MACH-107577 - Structural Materials (40CP)

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
Exams					
WT 25/26	76-T-MACH-105170	Welding Technology			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, 13.02.2026 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.

Die Forschungsuniversität in der Helmholtz-Gemeinschaft

Karlsruher Institut für Technologie

Amtliche Bekanntmachung

2025 **Ausgegeben Karlsruhe, den 21. Mai 2025** **Nr. 35**

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Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik

vom 20.05.2025

Aufgrund von § 10 Absatz 2 Ziffer 4 und § 20 Absatz 2 KIT-Gesetz in der Fassung vom 14. Juli 2009 (GBl. S. 317 f), zuletzt geändert durch Artikel 2 des Fünften Hochschulrechtsänderungsgesetzes vom 12. November 2024 (GBl. 2024 Nr. 97 S. 47 f.) und § 32 Ab-satz 3 Satz 1, 32 a Absatz 1 Satz 1 Landeshochschulgesetz in der Fassung vom 1. Januar 2005 zuletzt geändert durch Artikel 1 des Fünften Hochschulrechtsänderungsgesetzes vom 12. November 2024 (GBl. 2024 Nr. 97 S. 1 ff.) hat der KIT-Senat am 28.04.2025 die folgende Studien- und Prüfungsordnung für den Masterstudiengang Materialwissenschaft und Werkstofftechnik beschlossen.

Der Präsident hat seine Zustimmung gemäß § 20 Absatz 2 KIT-Gesetz i.V.m. § 32 Absatz 3 Satz 1 Landeshochschulgesetz am 20.05.2025 erteilt.

Inhaltsverzeichnis

II. Masterprüfung

III. Schlussbestimmungen

Präambel

Das KIT hat sich im Rahmen der Umsetzung des Bolognaprozesses zum Aufbau eines Europäischen Hochschulraumes zum Ziel gesetzt, dass am Abschluss des Studiums am KIT der Mastergrad stehen soll. Das KIT sieht daher die am KIT angebotenen konsekutiven Bachelor- und Masterstudiengänge als Gesamtkonzept mit konsekutivem Curriculum.

I. Allgemeine Bestimmungen

§ 1 Geltungsbereich

Diese Masterprüfungsordnung regelt Studienablauf, Prüfungen und den Abschluss des Studiums im Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT.

§ 2 Ziel des Studiums, akademischer Grad

(1) [1]Im konsekutiven Masterstudium sollen die im Bachelorstudium erworbenen wissenschaftlichen Qualifikationen weiter vertieft, verbreitert, erweitert oder ergänzt werden. [2]Ziel des Studiums ist die Fähigkeit, die wissenschaftlichen Erkenntnisse und Methoden selbstständig anzuwenden und ihre Bedeutung und Reichweite für die Lösung komplexer wissenschaftlicher und gesellschaftlicher Problemstellungen zu bewerten.

(2) Aufgrund der bestandenen Masterprüfung wird der akademische Grad „Master of Science (M.Sc.)“ für den Masterstudiengang Materialwissenschaft und Werkstofftechnik verliehen.

§ 3 Regelstudienzeit, Studienaufbau, Leistungspunkte

(1) Die Regelstudienzeit beträgt vier Semester.

(2) [1]Das Lehrangebot des Studiengangs ist in Fächer, die Fächer sind in Module, die jeweiligen Module in Lehrveranstaltungen gegliedert. [2]Die Fächer und ihr Umfang werden in § 19 festgelegt. [3]Näheres beschreibt das Modulhandbuch.

(3) [1]Der für das Absolvieren von Lehrveranstaltungen und Modulen vorgesehene Arbeitsaufwand wird in Leistungspunkten (LP) ausgewiesen. [2]Die Maßstäbe für die Zuordnung von Leistungspunkten entsprechen dem European Credit Transfer System (ECTS). [3]Ein Leistungspunkt entspricht einem Arbeitsaufwand von etwa 30 Zeitstunden. [4]Die Verteilung der Leistungspunkte auf die Semester hat in der Regel gleichmäßig zu erfolgen.

(4) Der Umfang der für den erfolgreichen Abschluss des Studiums erforderlichen Studien- und Prüfungsleistungen wird in Leistungspunkten gemessen und beträgt insgesamt 120 Leistungspunkte.

(5) Lehrveranstaltungen können in deutscher und in englischer Sprache angeboten werden.

§ 4 Modulprüfungen, Studien- und Prüfungsleistungen

(1) [1]Die Masterprüfung besteht aus Modulprüfungen. [2]Modulprüfungen bestehen aus einer oder mehreren Erfolgskontrollen. [3]Erfolgskontrollen gliedern sich in Studien- oder Prüfungsleistungen.

(2) Prüfungsleistungen sind:

1. schriftliche Prüfungen,
2. mündliche Prüfungen oder
3. Prüfungsleistungen anderer Art.

(3) [1]Studienleistungen sind schriftliche, mündliche oder praktische Leistungen, die von den Studierenden in der Regel lehrveranstaltungsbegleitend erbracht werden. [2]Die Masterprüfung darf nicht mit einer Studienleistung abgeschlossen werden.

(4) Von den Modulprüfungen sollen mindestens 70 % benotet sein.

(5) [1]Bei sich ergänzenden Inhalten können die Modulprüfungen mehrerer Module durch eine auch modulübergreifende Prüfungsleistung (Absatz 2 Nummer 1 bis 3) ersetzt werden. [2]Die Erfolgskontrolle zu Prüfungsleistungen anderer Art kann aus mehreren Komponenten bestehen.

§ 5 Anmeldung und Zulassung zu den Modulprüfungen und Lehrveranstaltungen

(1) [1]Um an den Modulprüfungen teilnehmen zu können, müssen sich die Studierenden online im Studierendenportal zu den jeweiligen Erfolgskontrollen anmelden. [2]In Ausnahmefällen kann eine Anmeldung schriftlich beim Prüfungsausschuss erfolgen. [3]Für die Erfolgskontrollen können durch die Prüfenden Anmeldefristen festgelegt werden. [4]Die Anmeldung der Masterarbeit erfolgt online im Studierendenportal, näheres ist im Modulhandbuch geregelt.

(2) [1]Sofern Wahlmöglichkeiten bestehen, müssen Studierende, um zu einer Prüfung in einem bestimmten Modul zugelassen zu werden, vor der ersten Prüfung in diesem Modul mit der Anmeldung zu der Prüfung eine bindende Erklärung über die Wahl des betreffenden Moduls und dessen Zuordnung zu einem Fach abgeben. [2]Sofern Wahlmöglichkeiten in einem Modul bestehen, müssen die Studierenden mit der Anmeldung zu der Erfolgskontrolle zusätzlich eine bindende Erklärung über die Wahl der betreffenden Erfolgskontrolle abgeben. [3]Auf Antrag der Studierenden oder des Studierenden an den Prüfungsausschuss kann die Wahl des Moduls bzw. der Erfolgskontrolle oder die Zuordnung des Moduls zu einem Fach nachträglich geändert werden. [4]Sofern bereits ein Prüfungsverfahren in einem Modul begonnen wurde, ist die Änderung der Wahl des Moduls oder der Erfolgskontrolle sowie der Zuordnung zu einem Fach erst nach Bestehen der Prüfung zulässig; dies gilt nur für Prüfungsleistungen.

(3) Zu einer Erfolgskontrolle ist zuzulassen, wer

1. in den Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT eingeschrieben ist; die Zulassung beurlaubter Studierender ist auf Prüfungsleistungen im Sinne des § 14 Absatz 8 Satz 1 der Zulassungs- und Immatrikulationsordnung des KIT beschränkt; und
2. nachweist, dass er die im Modulhandbuch für die Zulassung zu einer Erfolgskontrolle festgelegten Voraussetzungen erfüllt und
3. nachweist, dass er in dem Masterstudiengang Materialwissenschaft und Werkstofftechnik den Prüfungsanspruch nicht verloren hat und
4. die in § 19 a genannte Voraussetzung erfüllt.

(4) [1]Nach Maßgabe von § 30 Absatz 5 Landeshochschulgesetz kann die Zulassung zu einzelnen Pflichtveranstaltungen beschränkt werden. [2]Der/die Prüfende entscheidet über die Auswahl unter den Studierenden, die sich rechtzeitig bis zu dem von dem/der Prüfenden festgesetzten Termin angemeldet haben unter Berücksichtigung des Studienfortschritts dieser Studierenden und unter Beachtung von § 4 Absatz 1 Satz 1 und 2 der Satzung über Nachteilsausgleichende Regelungen in den Bachelor- und Masterstudiengängen am Karlsruher Institut für Technologie (KIT) in der jeweils geltenden Fassung, sofern ein Abbau des Überhangs durch andere oder zusätzliche Veranstaltungen nicht möglich ist. [3]Für den Fall gleichen Studienfortschritts sind durch die KIT-Fakultäten weitere Kriterien festzulegen. [4]Das Ergebnis wird den Studierenden rechtzeitig bekannt gegeben.

(5) [1]Die Zulassung ist zu versagen, wenn die in Absatz 3 und 4 genannten Voraussetzungen nicht erfüllt sind. [2]Die Zulassung kann versagt werden, wenn die betreffende Erfolgskontrolle bereits in einem grundständigen Bachelorstudiengang am KIT erbracht wurde, der Zulassungsvoraussetzung für diesen Masterstudiengang gewesen ist. [3]Dies gilt nicht für Mastervorzugsleistungen. [4]Zu diesen ist eine Zulassung nach Maßgabe von Satz 1 ausdrücklich zu genehmigen.

§ 6 Durchführung von Erfolgskontrollen

(1) Erfolgskontrollen werden studienbegleitend, in der Regel im Verlauf der Vermittlung der Lehrinhalte der einzelnen Module oder zeitnah danach, durchgeführt.

(2) [1]Die Art der Erfolgskontrolle (§ 4 Absatz 2 Nummer 1 bis 3, Absatz 3) wird von der/dem Prüfenden der betreffenden Lehrveranstaltung in Bezug auf die Lerninhalte der Lehrveranstaltung und die Qualifikationsziele des Moduls festgelegt. [2]Die Art der Erfolgskontrolle, ihre Häufigkeit, Reihenfolge und Gewichtung sowie gegebenenfalls die Bildung der Modulnote müssen mindestens sechs Wochen vor Vorlesungsbeginn im Modulhandbuch bekannt gemacht werden. [3]Im Einvernehmen von Prüfender bzw. Prüfendem und Studierender bzw. Studierendem können die Art der Prüfungsleistung sowie die Prüfungssprache auch nachträglich geändert werden; im ersten Fall ist jedoch § 4 Absatz 4 zu berücksichtigen. [4]Bei der Prüfungsorganisation sind die Belange Studierender in besonderen Lebenslagen gemäß § 4 Absatz 1 der Satzung über nachteilsausgleichende Regelungen in den Bachelor- und Masterstudiengängen am Karlsruher Institut für Technologie (KIT) in der jeweils geltenden Fassung zu berücksichtigen. [5]§ 2 und § 4 Absatz 1 Satz 3 der Satzung über Nachteilsausgleichende Regelungen in den Bachelor- und Masterstudiengängen am Karlsruher Institut für Technologie (KIT) in der jeweils geltenden Fassung gelten entsprechend.

(3) [1]Bei unvertretbar hohem Prüfungsaufwand kann eine schriftlich durchzuführende Prüfungsleistung auch mündlich, oder eine mündlich durchzuführende Prüfungsleistung auch schriftlich abgenommen werden. [2]Diese Änderung muss mindestens sechs Wochen vor der Prüfungsleistung bekannt gegeben werden.

(4) Bei Lehrveranstaltungen in englischer Sprache (§ 3 Absatz 5) sollen die entsprechenden Erfolgskontrollen in dieser Sprache abgenommen werden. § 6 Absatz 2 gilt entsprechend.

(5) [1]*Schriftliche Prüfungen* (§ 4 Absatz 2 Nummer 1) sind in der Regel von einer/einem Prüfenden nach § 17 Absatz 2 oder 3 zu bewerten. [2]Sofern eine Bewertung durch mehrere Prüfende erfolgt, ergibt sich die Note aus dem arithmetischen Mittel der Einzelbewertungen. [3]Entspricht das arithmetische Mittel keiner der in § 7 Absatz 2 Satz 2 definierten Notenstufen, so ist auf die nächstliegende Notenstufe auf- oder abzurunden. [4]Bei gleichem Abstand ist auf die nächstbessere Notenstufe zu runden. [5]Das Bewertungsverfahren soll sechs Wochen nicht überschreiten. [6]Schriftliche Prüfungen dauern mindestens 60 und höchstens 300 Minuten.

(6) [1]*Mündliche Prüfungen* (§ 4 Absatz 2 Nummer 2) sind von mehreren Prüfenden (Kollegialprüfung) oder von einer/m Prüfenden in Gegenwart einer oder eines Beisitzenden als Gruppen- oder Einzelprüfungen abzunehmen und zu bewerten. [2]Vor der Festsetzung der Note hört die/der Prüfende die anderen an der Kollegialprüfung mitwirkenden Prüfenden an. [3]Mündliche Prüfungen dauern in der Regel mindestens 15 Minuten und maximal 60 Minuten pro Studierenden.

[1]Die wesentlichen Gegenstände und Ergebnisse der *mündlichen Prüfung* sind in einem Protokoll festzuhalten. [2]Das Ergebnis der Prüfung ist den Studierenden im Anschluss an die mündliche Prüfung bekanntzugeben.

[1]Studierende, die sich in einem späteren Semester der gleichen Prüfung unterziehen wollen, werden entsprechend den räumlichen Verhältnissen und nach Zustimmung des Prüflings als Zuhörerinnen und Zuhörer bei mündlichen Prüfungen zugelassen. [2]Die Zulassung erstreckt sich nicht auf die Beratung und Bekanntgabe der Prüfungsergebnisse.

(7) [1]Für *Prüfungsleistungen anderer Art* (§ 4 Absatz 2 Nummer 3) sind angemessene Bearbeitungsfristen einzuräumen und Abgabetermine festzulegen. [2]Dabei ist durch die Art der Aufgabenstellung und durch entsprechende Dokumentation sicherzustellen, dass die erbrachte Prüfungsleistung dem/der Studierenden zurechenbar ist. [3]Die wesentlichen Gegenstände und Ergebnisse der Erfolgskontrolle sind in einem Protokoll festzuhalten.

[1]Bei *mündlich* durchgeführten *Prüfungsleistungen anderer Art* muss neben der/dem Prüfenden ein/e Beisitzende/r anwesend sein, die/der zusätzlich zum/r Prüfenden das Protokoll zeichnet.

[1]*Schriftliche Arbeiten* im Rahmen einer *Prüfungsleistung anderer Art* haben dabei die folgende Erklärung zu tragen: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben,

was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde.“ [2]Trägt die Arbeit diese Erklärung nicht, wird sie nicht angenommen. [3]Die wesentlichen Gegenstände und Ergebnisse einer solchen Erfolgskontrolle sind in einem Protokoll festzuhalten.

§ 6 a Erfolgskontrollen im Antwort-Wahl-Verfahren

Für die Durchführung von Erfolgskontrollen im Antwort-Wahl-Verfahren findet die Satzung des Karlsruher Instituts für Technologie (KIT) zur Durchführung von Erfolgskontrollen im Antwort-Wahl-Verfahren in der jeweils gültigen Fassung Anwendung.

§ 6 b Online-Prüfungen

Für die Durchführung von Online-Prüfungen findet die Satzung zur Durchführung von Online-Prüfungen am Karlsruher Institut für Technologie (KIT) in der jeweils gültigen Fassung Anwendung.

§ 7 Bewertung von Studien- und Prüfungsleistungen

(1) [1]Das Ergebnis einer Prüfungsleistung wird von den jeweiligen Prüfenden in Form einer Note festgesetzt. [2]Besteht eine Prüfungsleistung anderer Art aus mehreren Komponenten (§ 4 Absatz 5 Satz 2) wird entsprechend Satz 1 eine Note für das Ergebnis der Prüfungsleistung festgesetzt; Näheres regelt das Modulhandbuch.

(2) Folgende Noten sollen verwendet werden:

sehr gut (very good)	:	hervorragende Leistung,
gut (good)	:	eine Leistung, die erheblich über den durchschnittlichen Anforderungen liegt,
befriedigend (satisfactory)	:	eine Leistung, die durchschnittlichen Anforderungen entspricht,
ausreichend (sufficient)	:	eine Leistung, die trotz ihrer Mängel noch den Anforderungen genügt,
nicht ausreichend (failed)	:	eine Leistung, die wegen erheblicher Mängel nicht den Anforderungen genügt.

Zur differenzierten Bewertung einzelner Prüfungsleistungen sind nur folgende Noten zugelassen:

1,0; 1,3	:	sehr gut
1,7; 2,0; 2,3	:	gut
2,7; 3,0; 3,3	:	befriedigend
3,7; 4,0	:	ausreichend
5,0	:	nicht ausreichend

(3) Studienleistungen werden mit „bestanden“ oder mit „nicht bestanden“ gewertet.

(4) Bei der Bildung der gewichteten Durchschnitte der Modulnoten, der Fachnoten und der Gesamtnote wird nur die erste Dezimalstelle hinter dem Komma berücksichtigt; alle weiteren Stellen werden ohne Rundung gestrichen.

(5) Jedes Modul und jede Erfolgskontrolle darf in demselben Studiengang nur einmal gewertet werden.

(6) [1]Eine Prüfungsleistung ist bestanden, wenn die Note mindestens „ausreichend“ (4,0) ist. [2]Besteht eine Prüfungsleistung anderer Art aus mehreren Komponenten, ist die Prüfungsleistung bestanden, wenn die Note nach Absatz 1 Satz 2 mindestens „ausreichend“ (4,0) ist.

(7) [1]Die Modulprüfung ist bestanden, wenn alle erforderlichen Erfolgskontrollen bestanden sind. [2]Die Modulprüfung und die Bildung der Modulnote sollen im Modulhandbuch geregelt werden. [3]Sofern das Modulhandbuch keine Regelung über die Bildung der Modulnote enthält, errechnet sich die Modulnote aus einem nach den Leistungspunkten der einzelnen Teilmodule gewichteten Notendurchschnitt. [4]Die differenzierten Noten (Absatz 2) sind bei der Berechnung der Modulnoten als Ausgangsdaten zu verwenden.

(8) Die Ergebnisse der Erfolgskontrollen sowie die erworbenen Leistungspunkte werden durch den Studierendenservice des KIT verwaltet.

(9) Die Noten der Module eines Faches gehen in die Fachnote mit einem Gewicht proportional zu den ausgewiesenen Leistungspunkten der Module ein.

(10) Die Gesamtnote der Masterprüfung, die Fachnoten und die Modulnoten lauten:

		bis	1,5	=	sehr gut
von	1,6	bis	2,5	=	gut
von	2,6	bis	3,5	=	befriedigend
von	3,6	bis	4,0	=	ausreichend

§ 8 Wiederholung von Erfolgskontrollen, endgültiges Nichtbestehen

(1) [1]Studierende können eine nicht bestandene schriftliche Prüfung (§ 4 Absatz 2 Nr. 1) einmal wiederholen. [2]Wird eine schriftliche Wiederholungsprüfung mit „nicht ausreichend“ (5,0) bewertet, so erfolgt in zeitlichem Zusammenhang eine mündliche Fortsetzung der Wiederholungsprüfung (mündliche Nachprüfung). [3]Die Note der Wiederholungsprüfung, die in diesem Fall nur „ausreichend“ (4,0) oder „nicht ausreichend“ (5,0) lauten kann, wird von den Prüfenden bzw. der/dem Prüfenden unter angemessener Berücksichtigung der schriftlichen Leistung und des Ergebnisses der mündlichen Nachprüfung festgesetzt. [4]Mündliche Nachprüfungen dauern in der Regel mindestens 15 Minuten und maximal 30 Minuten. [5]§ 6 Absatz 6 Satz 1 und 2 sowie Satz 4 und 5 gelten entsprechend. [6]Sofern gemäß § 11 eine schriftliche Wiederholungsprüfung als mit „nicht ausreichend“ (5,0) bewertet gilt, ist eine mündliche Nachprüfung ausgeschlossen.

(2) Studierende können eine nicht bestandene mündliche Prüfung (§ 4 Absatz 2 Nummer 2) einmal wiederholen.

(3) [1]Wiederholungsprüfungen nach Absatz 1 und 2 müssen in Inhalt, Umfang und Form (mündlich oder schriftlich) der ersten entsprechen. [2]Ausnahmen kann der zuständige Prüfungsausschuss auf Antrag zulassen.

(4) Prüfungsleistungen anderer Art (§ 4 Absatz 2 Nummer 3) können einmal wiederholt werden.

(5) Studienleistungen können mehrfach wiederholt werden.

(6) [1]Die Prüfungsleistung ist endgültig nicht bestanden, wenn die mündliche Nachprüfung im Sinne des Absatzes 1 mit „nicht ausreichend“ (5,0) bewertet wurde. [2]Die Prüfungsleistung ist ferner endgültig nicht bestanden, wenn die mündliche Prüfung im Sinne des Absatzes 2 oder die Prüfungsleistung anderer Art gemäß Absatz 4 zweimal mit „nicht bestanden“ bewertet wurde.

(7) Das Modul ist endgültig nicht bestanden, wenn eine für sein Bestehen erforderliche Prüfungsleistung endgültig nicht bestanden ist.

(8) [1]Eine zweite Wiederholung derselben Prüfungsleistung gemäß § 4 Absatz 2 ist nur in Ausnahmefällen auf Antrag des/der Studierenden zulässig („Antrag auf Zweitwiederholung“). [2]Der Antrag ist schriftlich beim Prüfungsausschuss in der Regel bis zwei Monate nach Bekanntgabe der Note zu stellen.

[1]Über den ersten Antrag eines/r Studierenden auf Zweitwiederholung entscheidet der Prüfungsausschuss, wenn er den Antrag genehmigt. [2]Wenn der Prüfungsausschuss diesen Antrag ablehnt, entscheidet ein Mitglied des Präsidiums. [3]Über weitere Anträge auf Zweitwiederholung entscheidet nach Stellungnahme des Prüfungsausschusses ein Mitglied des Präsidiums. [4]Wird

der Antrag genehmigt, hat die Zweitwiederholung spätestens zum übernächsten Prüfungstermin zu erfolgen. [5]Absatz 1 Satz 2 bis 6 gelten entsprechend.

(9) Die Wiederholung einer bestandenen Prüfungsleistung ist nicht zulässig.

(10) [1]Die Masterarbeit kann bei einer Bewertung mit „nicht ausreichend“ (5,0) einmal wiederholt werden. [2]Eine zweite Wiederholung der Masterarbeit ist ausgeschlossen.

§ 9 Verlust des Prüfungsanspruchs

[1]Ist eine nach dieser Studien- und Prüfungsordnung erforderliche Studien- oder Prüfungsleistung endgültig nicht bestanden oder die Masterprüfung bis zum Ende des siebenten Fachsemesters einschließlich etwaiger Wiederholungen nicht vollständig abgelegt, so erlischt der Prüfungsanspruch im Masterstudiengang Materialwissenschaft und Werkstofftechnik, es sei denn, dass die Fristüberschreitung nicht selbst zu vertreten ist. [2]Die Entscheidung über eine Fristverlängerung und über Ausnahmen von der Fristregelung trifft der Prüfungsausschuss unter Beachtung der in § 32 Absatz 6 Landeshochschulgesetz genannten Tätigkeiten auf Antrag des/der Studierenden. [3]Der Antrag ist schriftlich in der Regel bis sechs Wochen vor Ablauf der Frist zu stellen.

§ 10 Abmeldung; Versäumnis, Rücktritt

(1) [1]Studierende können ihre Anmeldung zu *schriftlichen Prüfungen* ohne Angabe von Gründen bis zur Ausgabe der Prüfungsaufgaben widerrufen (Abmeldung). [2]Eine Abmeldung kann online im Studierendenportal bis 24:00 Uhr des Vortages der Prüfung oder in begründeten Ausnahmefällen beim Prüfungsausschuss erfolgen. [3]Erfolgt die Abmeldung gegenüber dem/der Prüfenden hat diese/r Sorge zu tragen, dass die Abmeldung im Campus Management System verbucht wird.

(2) [1]Bei *mündlichen Prüfungen* muss die Abmeldung spätestens drei Werktage vor dem betreffenden Prüfungstermin gegenüber dem/der Prüfenden erklärt werden. [2]Der Rücktritt von einer mündlichen Prüfung weniger als drei Werktage vor dem betreffenden Prüfungstermin ist nur unter den Voraussetzungen des Absatzes 5 möglich. [3]Der Rücktritt von mündlichen Nachprüfungen im Sinne von § 8 Absatz 1 ist grundsätzlich nur unter den Voraussetzungen von Absatz 5 möglich.

(3) Die Abmeldung von *Prüfungsleistungen anderer Art* sowie von *Studienleistungen* ist im Modulhandbuch geregelt.

(4) [1]Eine Erfolgskontrolle gilt als mit „nicht ausreichend“ (5,0) bewertet, wenn die Studierenden einen Prüfungstermin ohne triftigen Grund versäumen oder wenn sie nach Beginn der Erfolgskontrolle ohne triftigen Grund von dieser zurücktreten. [2]Dasselbe gilt, wenn die Masterarbeit nicht innerhalb der vorgesehenen Bearbeitungszeit erbracht wird, es sei denn, der/die Studierende hat die Fristüberschreitung nicht zu vertreten.

(5) [1]Der für den Rücktritt nach Beginn der Erfolgskontrolle oder das Versäumnis geltend gemachte Grund muss dem Prüfungsausschuss unverzüglich schriftlich angezeigt und glaubhaft gemacht werden. [2]Bei Krankheit des/der Studierenden oder eines allein zu versorgenden Kindes oder pflegebedürftigen Angehörigen kann die Vorlage eines ärztlichen Attestes verlangt werden.

§ 11 Täuschung, Ordnungsverstoß

(1) Versuchen Studierende das Ergebnis ihrer Erfolgskontrolle durch Täuschung oder Benutzung nicht zugelassener Hilfsmittel zu beeinflussen, gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet.

(2) [1]Studierende, die den ordnungsgemäßen Ablauf einer Erfolgskontrolle stören, können von der/dem Prüfenden oder der Aufsicht führenden Person von der Fortsetzung der Erfolgskontrolle ausgeschlossen werden. [2]In diesem Fall gilt die betreffende Erfolgskontrolle als mit „nicht ausreichend“ (5,0) bewertet. [3]In schwerwiegenden Fällen kann der Prüfungsausschuss diese Studierenden von der Erbringung weiterer Erfolgskontrollen ausschließen.

(3) Näheres regelt die Allgemeine Satzung des KIT zur Redlichkeit bei Prüfungen und Praktika in der jeweils gültigen Fassung.

§ 12 Mutterschutz, Elternzeit, Wahrnehmung von Familienpflichten

Für den Ausgleich von Nachteilen bei Studierenden in besonderen Lebenslagen findet die Satzung über nachteilsausgleichende Regelungen in den Bachelor- und Masterstudiengängen am Karlsruher Institut für Technologie (KIT) in der jeweils geltenden Fassung Anwendung.

§ 13 Studierende mit Behinderung oder chronischer Erkrankung

Für den Ausgleich von Nachteilen bei Studierenden in besonderen Lebenslagen findet die Satzung über nachteilsausgleichende Regelungen in den Bachelor- und Masterstudiengängen am Karlsruher Institut für Technologie (KIT) in der jeweils geltenden Fassung Anwendung.

§ 14 Modul Masterarbeit

(1) [1]Voraussetzung für die Zulassung zum Modul Masterarbeit ist, dass die/der Studierende Modulprüfungen im Umfang von 74 LP erfolgreich abgelegt hat. [2]Über Ausnahmen entscheidet der Prüfungsausschuss auf Antrag der/des Studierenden.

(1 a) [1]Dem Modul Masterarbeit sind 30 LP zugeordnet. [2]Es besteht aus der Masterarbeit und einer Präsentation. [3]Die Präsentation soll spätestens sechs Wochen nach Abgabe der Masterarbeit erfolgen.

(2) [1]Die Masterarbeit kann von Hochschullehrerinnen und Hochschullehrern am KIT und habilitierten Mitgliedern der KIT-Fakultät für Maschinenbau vergeben werden. [2]Darüber hinaus kann der Prüfungsausschuss weitere Prüfende gemäß § 17 Absatz 2 und 3 zur Vergabe des Themas berechtigen. [3]Den Studierenden ist Gelegenheit zu geben, für das Thema Vorschläge zu machen. [4]Soll die Masterarbeit außerhalb der KIT-Fakultäten für Maschinenbau, Chemie und Biowissenschaften, Chemieingenieurwesen und Verfahrenstechnik, Elektrotechnik und Informationstechnik oder Physik angefertigt werden, so bedarf dies der Genehmigung durch den Prüfungsausschuss. [5]Die Masterarbeit kann auch in Form einer Gruppenarbeit zugelassen werden, wenn der als Prüfungsleistung zu bewertende Beitrag der/des einzelnen Studierenden aufgrund objektiver Kriterien, die eine eindeutige Abgrenzung ermöglichen, deutlich unterscheidbar ist und die Anforderung nach Absatz 4 erfüllt. [6]In Ausnahmefällen sorgt die/der Vorsitzende des Prüfungsausschusses auf Antrag der oder des Studierenden dafür, dass die/der Studierende innerhalb von vier Wochen ein Thema für die Masterarbeit erhält. [7]Die Ausgabe des Themas erfolgt in diesem Fall über die/den Vorsitzende/n des Prüfungsausschusses.

(3) Thema, Aufgabenstellung und Umfang der Masterarbeit sind von dem Betreuer bzw. der Betreuerin so zu begrenzen, dass sie mit dem in Absatz 4 festgelegten Arbeitsaufwand bearbeitet werden kann.

(4) [1]Die Masterarbeit soll zeigen, dass die Studierenden in der Lage sind, ein Problem aus ihrem Studienfach selbstständig und in begrenzter Zeit nach wissenschaftlichen Methoden zu bearbeiten. [2]Der Umfang der Masterarbeit entspricht 30 Leistungspunkten. [3]Die maximale Bearbeitungsdauer beträgt sechs Monate. [4]Thema und Aufgabenstellung sind an den vorgesehenen Umfang anzupassen. [5]Der Prüfungsausschuss legt fest, in welchen Sprachen die Masterarbeit geschrieben werden kann. [6]Auf Antrag des Studierenden kann der/die Prüfende genehmigen, dass die Masterarbeit in einer anderen Sprache als Deutsch oder Englisch geschrieben wird.

(5) [1]Bei der Abgabe der Masterarbeit haben die Studierenden schriftlich zu versichern, dass sie die Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt haben, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen

Fassung beachtet haben. [2]Wenn diese Erklärung nicht enthalten ist, wird die Arbeit nicht angenommen. [3]Die Erklärung kann wie folgt lauten: „Ich versichere wahrheitsgemäß, die Arbeit selbstständig verfasst, alle benutzten Quellen und Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben.“ [4]Bei Abgabe einer unwahren Versicherung wird die Masterarbeit mit „nicht ausreichend“ (5,0) bewertet.

(6) [1]Der Zeitpunkt der Ausgabe des Themas der Masterarbeit ist durch die Betreuerin/den Betreuer und die/den Studierenden festzuhalten und dies beim Prüfungsausschuss aktenkundig zu machen. [2]Der Zeitpunkt der Abgabe der Masterarbeit ist durch den/die Prüfende/n beim Prüfungsausschuss aktenkundig zu machen. [3]Das Thema kann nur einmal und nur innerhalb des ersten Monats der Bearbeitungszeit zurückgegeben werden. [4]Macht der oder die Studierende einen triftigen Grund geltend, kann der Prüfungsausschuss die in Absatz 4 festgelegte Bearbeitungszeit auf Antrag der oder des Studierenden um höchstens drei Monate verlängern. [5]Wird die Masterarbeit nicht fristgerecht abgeliefert, gilt sie als mit „nicht ausreichend“ (5,0) bewertet, es sei denn, dass die Studierenden dieses Versäumnis nicht zu vertreten haben.

(7) [1]Die Masterarbeit wird von mindestens einer Hochschullehrerin oder einem Hochschullehrer am KIT oder einem habilitierten Mitglied der KIT-Fakultät für Maschinenbau und einem/einer weiteren Prüfenden bewertet. [2]In der Regel ist eine/r der Prüfenden die Person, die die Arbeit gemäß Absatz 2 vergeben hat. [3]Bei nicht übereinstimmender Beurteilung dieser beiden Personen setzt der Prüfungsausschuss im Rahmen der Bewertung dieser beiden Personen die Note der Masterarbeit fest; er kann auch eine/n weitere/n Gutachter/in bestellen. [4]Die Bewertung hat innerhalb von acht Wochen nach Abgabe der Masterarbeit zu erfolgen.

§ 14 a Berufspraktikum

(1) [1]Während des Masterstudiums ist ein mindestens neunwöchiges Berufspraktikum abzuleisten, welches geeignet ist, den Studierenden eine Anschauung von berufspraktischer Tätigkeit in Materialwissenschaft und Werkstofftechnik zu vermitteln. [2]Dem Berufspraktikum sind 12 Leistungspunkte zugeordnet.

(2) [1]Die Studierenden setzen sich in eigener Verantwortung mit geeigneten privaten oder öffentlichen Einrichtungen in Verbindung, an denen das Praktikum abgeleistet werden kann. [2]Das Nähere regelt das Modulhandbuch.

§ 15 Zusatzleistungen

(1) [1]Es können auch weitere Leistungspunkte (Zusatzleistungen) im Umfang von höchstens 30 LP aus dem Gesamtangebot des KIT erworben werden. [2]§ 3 und § 4 der Prüfungsordnung bleiben davon unberührt. [3]Diese Zusatzleistungen gehen nicht in die Festsetzung der Gesamt- und Modulnoten ein. [4]Die bei der Festlegung der Modulnote nicht berücksichtigten LP werden als Zusatzleistungen im Transcript of Records aufgeführt und als Zusatzleistungen gekennzeichnet. [5]Auf Antrag der/des Studierenden werden die Zusatzleistungen in das Masterzeugnis aufgenommen und als Zusatzleistungen gekennzeichnet. [6]Zusatzleistungen werden mit den nach § 7 vorgesehenen Noten gelistet.

(2) Die Studierenden haben bereits bei der Anmeldung zu einer Prüfung in einem Modul diese als Zusatzleistung zu deklarieren.

§ 15 a Überfachliche Qualifikationen

[1]Neben der Vermittlung von fachlichen Qualifikationen legt das KIT Wert auf überfachliche Qualifikationen. [2]Diese sind im Umfang von zwei LP Bestandteil des Masterstudiengangs Materialwissenschaft und Werkstofftechnik. [3]Überfachliche Qualifikationen können additiv oder integrativ vermittelt werden.

§ 16 Prüfungsausschuss

(1) [1]Für den Masterstudiengang Materialwissenschaft und Werkstofftechnik wird ein Prüfungsausschuss gebildet. [2]Er besteht aus vier stimmberechtigten Mitgliedern: zwei Hochschullehrerinnen und Hochschullehrer am KIT / Privatdozentinnen bzw. -dozenten, zwei akademischen Mitarbeiterinnen und akademischen Mitarbeitern am KIT und einer bzw. einem Studierenden mit beratender Stimme. [3]Im Falle der Einrichtung eines gemeinsamen Prüfungsausschusses für den Bachelor- und den Masterstudiengang Materialwissenschaft und Werkstofftechnik erhöht sich die Anzahl der Studierenden auf zwei Mitglieder mit beratender Stimme, wobei je eine bzw. einer dieser Beiden aus dem Bachelor- und aus dem Masterstudiengang stammen soll. [4]Die Amtszeit der nichtstudentischen Mitglieder beträgt zwei Jahre, die des studentischen Mitglieds ein Jahr.

(2) [1]Die/der Vorsitzende, ihre/sein Stellvertreter/in, die weiteren Mitglieder des Prüfungsausschusses sowie deren Stellvertreter/innen werden von dem KIT-Fakultätsrat bestellt, die akademischen Mitarbeiterinnen bzw. akademischen Mitarbeiter am KIT und die Studierenden auf Vorschlag der Mitglieder der jeweiligen Gruppe; Wiederbestellung ist möglich. [2]Die/der Vorsitzende und deren/dessen Stellvertreter/in müssen Hochschullehrerinnen oder Hochschullehrer /am KIT sein. [3]Die/der Vorsitzende des Prüfungsausschusses nimmt die laufenden Geschäfte wahr und wird durch das jeweilige Prüfungssekretariat unterstützt.

(3) [1]Der Prüfungsausschuss achtet auf die Einhaltung der Bestimmungen dieser Studien- und Prüfungsordnung und fällt die Entscheidungen in Prüfungsangelegenheiten. [2]Er entscheidet über die Anerkennung von Studienzeiten sowie Studien- und Prüfungsleistungen und trifft die Feststellung gemäß § 18 Absatz 1 Satz 1. [3]Er berichtet der KIT-Fakultät regelmäßig über die Entwicklung der Prüfungs- und Studienzeiten, einschließlich der Bearbeitungszeiten für die Masterarbeiten und die Verteilung der Modul- und Gesamtnoten. [4]Er ist zuständig für Anregungen zur Reform der Studien- und Prüfungsordnung und zu Modulbeschreibungen. [5]Der Prüfungsausschuss entscheidet mit der Mehrheit seiner Stimmen. [6]Bei Stimmengleichheit entscheidet die/der Vorsitzende des Prüfungsausschusses.

(4) [1]Der Prüfungsausschuss kann die Erledigung seiner Aufgaben für alle Regelfälle auf die/den Vorsitzende/n des Prüfungsausschusses übertragen. [2]In dringenden Angelegenheiten, deren Erledigung nicht bis zu der nächsten Sitzung des Prüfungsausschusses warten kann, entscheidet die/der Vorsitzende des Prüfungsausschusses.

(5) [1]Die Mitglieder des Prüfungsausschusses haben das Recht, der Abnahme von Prüfungen beizuwohnen. [2]Die Mitglieder des Prüfungsausschusses, die Prüfenden und die Beisitzenden unterliegen der Verschwiegenheit. [3]Sofern sie nicht im öffentlichen Dienst stehen, sind sie durch die/den Vorsitzende/n zur Verschwiegenheit zu verpflichten.

(6) In Angelegenheiten des Prüfungsausschusses, die eine an einer anderen KIT-Fakultät zu absolvierende Prüfungsleistung betreffen, ist auf Antrag eines Mitgliedes des Prüfungsausschusses eine fachlich zuständige und von der betroffenen KIT-Fakultät zu nennende prüfungsberechtigte Person hinzuzuziehen.

(7) [1]Belastende Entscheidungen des Prüfungsausschusses sind schriftlich mitzuteilen. [2]Sie sind zu begründen und mit einer Rechtsbehelfsbelehrung zu versehen. [3]Vor einer Entscheidung ist Gelegenheit zur Äußerung zu geben. [4]Widersprüche gegen Entscheidungen des Prüfungsausschusses sind innerhalb eines Monats nach Zugang der Entscheidung bei diesem einzulegen. [5]Über Widersprüche entscheidet das für Lehre zuständige Mitglied des Präsidiums.

§ 17 Prüfende und Beisitzende

(1) [1]Der Prüfungsausschuss bestellt die Prüfenden. [2]Er kann die Bestellung der/dem Vorsitzenden übertragen.

(2) [1]Prüfende sind Hochschullehrinnen bzw. Hochschullehrer am KIT, habilitierte Mitglieder und akademische Mitarbeiterinnen und Mitarbeiter am KIT, welche der KIT-Fakultät angehören und denen die Prüfungsbefugnis gemäß § 14 Absatz 2, § 14 b Absatz 1 Nummer 1 KIT-Gesetz i.V.m. § 52 Absatz 1 Satz 6 Halbsatz 2 Landeshochschulgesetz übertragen wurde. [2]Bestellt werden darf nur, wer mindestens die dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat.

(3) Soweit Lehrveranstaltungen von anderen als den unter Absatz 2 genannten Personen durchgeführt werden, sollen diese zu Prüfenden bestellt werden, sofern sie die gemäß Absatz 2 Satz 2 vorausgesetzte Qualifikation nachweisen können.

(4) [1]Die Beisitzenden werden durch die Prüfenden benannt. [2]Zu Beisitzenden darf nur benannt werden, wer eine dem jeweiligen Prüfungsgegenstand entsprechende fachwissenschaftliche Qualifikation erworben hat.

§ 18 Anerkennung von Studien- und Prüfungsleistungen, Studienzeiten

(1) [1]Studien- und Prüfungsleistungen sowie Studienzeiten, die in Studiengängen an staatlichen oder staatlich anerkannten Hochschulen und Berufsakademien der Bundesrepublik Deutschland oder an ausländischen staatlichen oder staatlich anerkannten Hochschulen erbracht wurden, werden auf Antrag der Studierenden anerkannt, sofern hinsichtlich der erworbenen Kompetenzen kein wesentlicher Unterschied zu den Leistungen oder Abschlüssen besteht, die ersetzt werden sollen. [2]Dabei ist kein schematischer Vergleich, sondern eine Gesamtbetrachtung vorzunehmen. [3]Bezüglich des Umfangs einer zur Anerkennung vorgelegten Studien- und Prüfungsleistung (Anrechnung) werden die Grundsätze des ECTS herangezogen.

(2) [1]Die Studierenden haben die für die Anerkennung erforderlichen Unterlagen vorzulegen. [2]Studierende, die neu in den Masterstudiengang Materialwissenschaft und Werkstofftechnik immatrikuliert wurden, haben den Antrag mit den für die Anerkennung erforderlichen Unterlagen innerhalb des ersten Semesters nach Immatrikulation zu stellen. [3]Bei Unterlagen, die nicht in deutscher oder englischer Sprache vorliegen, kann eine amtlich beglaubigte Übersetzung verlangt werden. [4]Die Beweislast dafür, dass der Antrag die Voraussetzungen für die Anerkennung nicht erfüllt, liegt beim Prüfungsausschuss.

(3) [1]Werden Leistungen angerechnet, die nicht am KIT erbracht wurden, werden sie im Zeugnis als „anerkannt“ ausgewiesen. [2]Liegen Noten vor, werden die Noten, soweit die Notensysteme vergleichbar sind, übernommen und in die Berechnung der Modulnoten und der Gesamtnote einbezogen. [3]Sind die Notensysteme nicht vergleichbar, können die Noten umgerechnet werden. [4]Liegen keine Noten vor, wird der Vermerk „bestanden“ aufgenommen.

(4) Bei der Anerkennung von Studien- und Prüfungsleistungen, die außerhalb der Bundesrepublik Deutschland erbracht wurden, sind die von der Kultusministerkonferenz und der Hochschulrektorenkonferenz gebilligten Äquivalenzvereinbarungen sowie Absprachen im Rahmen der Hochschulpartnerschaften zu beachten.

(5) [1]Außerhalb des Hochschulsystems erworbene Kenntnisse und Fähigkeiten werden angerechnet, wenn sie nach Inhalt und Niveau den Studien- und Prüfungsleistungen gleichwertig sind, die ersetzt werden sollen und die Institution, in der die Kenntnisse und Fähigkeiten erworben wurden, ein genormtes Qualitätssicherungssystem hat. [2]Die Anrechnung kann in Teilen versagt werden, wenn mehr als 50 Prozent des Hochschulstudiums ersetzt werden soll.

(6) [1]Zuständig für Anerkennung und Anrechnung ist der Prüfungsausschuss. [2]Im Rahmen der Feststellung, ob ein wesentlicher Unterschied im Sinne des Absatz 1 vorliegt, sind die zuständigen Fachvertreter/innen zu hören.

II. Masterprüfung

§ 19 Umfang und Art der Masterprüfung

(1) Die Masterprüfung besteht aus den Modulprüfungen nach Absatz 2 sowie dem Modul Masterarbeit (§ 14) und dem Berufspraktikum (§ 14 a).

(2) Es sind Modulprüfungen in den Modulen der Fächer „Materialwissenschaftliche Vertiefung“ (Umfang insgesamt 20 LP), „Interdisziplinäre Ergänzung (Umfang insgesamt 18 LP) und „Spezialisierung“ (Umfang insgesamt 40 LP) abzulegen.

1. In dem Fach „Materialwissenschaftliche Vertiefung“ sind Modulprüfungen in den folgenden Modulen abzulegen:
   a) Thermodynamik und Kinetik im Umfang von 7 LP,
   b) Eigenschaften im Umfang von 7 LP,
   c) Simulation im Umfang von 6 LP.
2. In dem Fach „Interdisziplinäre Ergänzung“ sind Modulprüfungen in den folgenden Modulen abzulegen:
   a) MINT Wahlmodul im Umfang von 12 LP,
   b) Technik und Gesellschaft im Umfang von 4 LP,
   c) Überfachliche Qualifikationen im Umfang von 2 LP.
3. In dem Fach „Spezialisierung“ sind ein Schwerpunktmodul im Umfang von 40 LP oder zwei Schwerpunktmodule im Umfang von 20 LP zu wählen. Die Festlegung der zur Auswahl stehenden Module wird im Modulhandbuch geregelt.

§ 19 a Leistungsnachweise für die Masterprüfung

[1]Voraussetzung für die Anmeldung zur letzten Modulprüfung der Masterprüfung ist die Bescheinigung über das erfolgreich abgeleistete Berufspraktikum nach § 14 a. [2]In Ausnahmefällen, die die Studierenden nicht zu vertreten haben, kann der Prüfungsausschuss die nachträgliche Vorlage dieses Leistungsnachweises genehmigen.

§ 20 Bestehen der Masterprüfung, Bildung der Gesamtnote

(1) Die Masterprüfung ist bestanden, wenn alle gemäß § 19 erforderlichen Modulprüfungen bestanden wurden.

(2) Die Gesamtnote der Masterprüfung errechnet sich als ein mit Leistungspunkten gewichteter Notendurchschnitt der Fachnoten und dem Modul Masterarbeit.

(3) Haben Studierende die Masterarbeit mit der Note 1,0 und die Masterprüfung mit einem Durchschnitt von 1,2 oder besser abgeschlossen, so wird das Prädikat „mit Auszeichnung“ (with distinction) verliehen.

§ 21 Masterzeugnis, Masterurkunde, Diploma Supplement und Transcript of Records

(1) [1]Über die Masterprüfung werden nach Bewertung der letzten Prüfungsleistung eine Masterurkunde und ein Zeugnis erstellt. [2]Die Ausfertigung von Masterurkunde und Zeugnis soll nicht später als drei Monate nach Ablegen der letzten Prüfungsleistung erfolgen. [3]Masterurkunde und Masterzeugnis werden in deutscher und englischer Sprache ausgestellt. [4]Masterurkunde und Zeugnis tragen das Datum der erfolgreichen Erbringung der letzten Prüfungsleistung. [5]Diese Dokumente werden den Studierenden zusammen ausgehändigt. [6]In der Masterurkunde wird die Verleihung des akademischen Mastergrades beurkundet. [7]Die Masterurkunde wird von dem Präsidenten des KIT und mit dem Siegel des KIT versehen.

(2) [1]Das Zeugnis enthält die Fach- und Modulnoten sowie die den Modulen und Fächern zugeordneten Leistungspunkte und die Gesamtnote. [2]Sofern gemäß § 7 Absatz 2 Satz 2 eine differenzierte Bewertung einzelner Prüfungsleistungen vorgenommen wurde, wird auf dem Zeugnis auch die entsprechende Dezimalnote ausgewiesen; § 7 Absatz 4 bleibt unberührt. [3]Das Zeugnis ist von der KIT-Dekanin/dem KIT-Dekan der KIT-Fakultät zu unterzeichnen.

(3) Mit dem Zeugnis erhalten die Studierenden ein Diploma Supplement in deutscher und englischer Sprache, das den Vorgaben des jeweils gültigen ECTS Users‘ Guide entspricht, sowie ein Transcript of Records in deutscher und englischer Sprache.

(4) [1]Das Transcript of Records enthält in strukturierter Form alle erbrachten Studien- und Prüfungsleistungen. [2]Dies beinhaltet alle Fächer und Fachnoten samt den zugeordneten Leistungspunkten, die dem jeweiligen Fach zugeordneten Module mit den Modulnoten und zugeordneten Leistungspunkten sowie die den Modulen zugeordneten Erfolgskontrollen samt Noten und zugeordneten Leistungspunkten. [3]Absatz 2 Satz 2 gilt entsprechend. [4]Aus dem Transcript of Records soll die Zugehörigkeit von Erfolgskontrollen zu den einzelnen Modulen deutlich erkennbar sein. [5]Angerechnete Studien- und Prüfungsleistungen sind im Transcript of Records aufzunehmen. [6]Alle Zusatzleistungen werden im Transcript of Records aufgeführt.

(5) Die Masterurkunde, das Masterzeugnis und das Diploma Supplement einschließlich des Transcript of Records werden vom Studierendenservice des KIT ausgestellt.

III. Schlussbestimmungen

§ 22 Bescheinigung von Prüfungsleistungen

[1]Haben Studierende die Masterprüfung endgültig nicht bestanden, wird ihnen auf Antrag und gegen Vorlage der Exmatrikulationsbescheinigung eine schriftliche Bescheinigung ausgestellt, die die erbrachten Studien- und Prüfungsleistungen und deren Noten enthält und erkennen lässt, dass die Prüfung insgesamt nicht bestanden ist. [2]Dasselbe gilt, wenn der Prüfungsanspruch erloschen ist.

§ 23 Aberkennung des Mastergrades

(1) [1]Haben Studierende bei einer Prüfungsleistung getäuscht und wird diese Tatsache nach der Aushändigung des Zeugnisses bekannt, so können die Noten der Modulprüfungen, bei denen getäuscht wurde, berichtigt werden. [2]Gegebenenfalls kann die Modulprüfung für „nicht ausreichend“ (5,0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

(2) [1]Waren die Voraussetzungen für die Zulassung zu einer Prüfung nicht erfüllt, ohne dass die/der Studierende darüber täuschen wollte, und wird diese Tatsache erst nach Aushändigung des Zeugnisses bekannt, wird dieser Mangel durch das Bestehen der Prüfung geheilt. [2]Hat die/der Studierende die Zulassung vorsätzlich zu Unrecht erwirkt, so kann die Modulprüfung für „nicht ausreichend“ (5,0) und die Masterprüfung für „nicht bestanden“ erklärt werden.

(3) Vor einer Entscheidung des Prüfungsausschusses ist Gelegenheit zur Äußerung zu geben.

(4) [1]Das unrichtige Zeugnis ist zu entziehen und gegebenenfalls ein neues zu erteilen. [2]Mit dem unrichtigen Zeugnis ist auch die Masterurkunde einzuziehen, wenn die Masterprüfung aufgrund einer Täuschung für „nicht bestanden“ erklärt wurde.

(5) Eine Entscheidung nach Absatz 1 und Absatz 2 Satz 2 ist nach einer Frist von fünf Jahren ab dem Datum des Zeugnisses ausgeschlossen.

(6) Die Aberkennung des akademischen Grades richtet sich nach § 36 Absatz 7 Landeshochschulgesetz.

§ 24 Einsicht in die Prüfungsakten

(1) Nach Abschluss der Masterprüfung wird den Studierenden auf Antrag innerhalb eines Jahres Einsicht in das Prüfungsexemplar ihrer Masterarbeit, die darauf bezogenen Gutachten und in die Prüfungsprotokolle gewährt.

(2) Für die Einsichtnahme in die schriftlichen Modulprüfungen, schriftlichen Modulteilprüfungen bzw. Prüfungsprotokolle gilt eine Frist von einem Monat nach Bekanntgabe des Prüfungsergebnisses.

(3) Der/die Prüfende bestimmt Ort und Zeit der Einsichtnahme.

(4) Prüfungsunterlagen sind mindestens fünf Jahre aufzubewahren.

§ 25 Inkrafttreten, Übergangsvorschriften

(1) Diese Studien- und Prüfungsordnung tritt am 01.Oktober 2025 in Kraft und gilt für

1. Studierende, die ihr Studium im Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT im ersten Fachsemester aufnehmen, sowie für
2. Studierende, die ihr Studium im Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT in einem höheren Fachsemester aufnehmen, sofern dieses Fachsemester nicht über dem Fachsemester liegt, das der erste Jahrgang nach Ziff. 1 erreicht.

(2) Die Studien- und Prüfungsordnung des KIT für den Masterstudiengang Materialwissenschaft und Werkstofftechnik vom 26.Juni.2017 (Amtliche Bekanntmachung des KIT Nr. 48 vom 27. Juni. 2017) zuletzt geändert durch Artikel 62 der Satzung zur Änderung der Studien- und Prüfungsordnungen des Karlsruher Institut für Technologie (KIT) aufgrund der Neugestaltung der Abschlussdokumente vom 26. Februar 2025 (Amtliche Bekanntmachung des KIT Nummer 12 vom 27. Februar 2025) behält Gültigkeit für

1. Studierende, die ihr Studium im Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT zuletzt im Sommersemester 2025 aufgenommen haben, sowie für
2. Studierende, die ihr Studium im Masterstudiengang Materialwissenschaft und Werkstofftechnik am KIT ab dem Wintersemester 2025/26 in einem höheren Fachsemester aufnehmen, sofern das Fachsemester über dem liegt, das der erste Jahrgang nach Absatz 1 Ziff. 1 erreicht hat.

Im Übrigen tritt sie außer Kraft.

(3) Studierende, die auf Grundlage der Studien- und Prüfungsordnung für den Masterstudiengang Materialwissenschaft und Werkstofftechnik vom 26. Juni 2017 (Amtliche Bekanntmachung des KIT Nr. 48 vom 27. Juni 2017) zuletzt geändert durch Artikel 62 der Satzung zur Änderung der Studien- und Prüfungsordnungen des Karlsruher Institut für Technologie (KIT) aufgrund der Neugestaltung der Abschlussdokumente vom 26. Februar 2025 (Amtliche Bekanntmachung des KIT Nummer 12 vom 27. Februar 2025) ihr Studium am KIT aufgenommen haben, können Prüfungen auf Grundlage dieser Studien- und Prüfungsordnung letztmalig bis zum 30. September 2030 ablegen.

Karlsruhe, den 20. Mai 2025

gez.

Prof. Dr. Jan S. Hesthaven

(Präsident des KIT)