

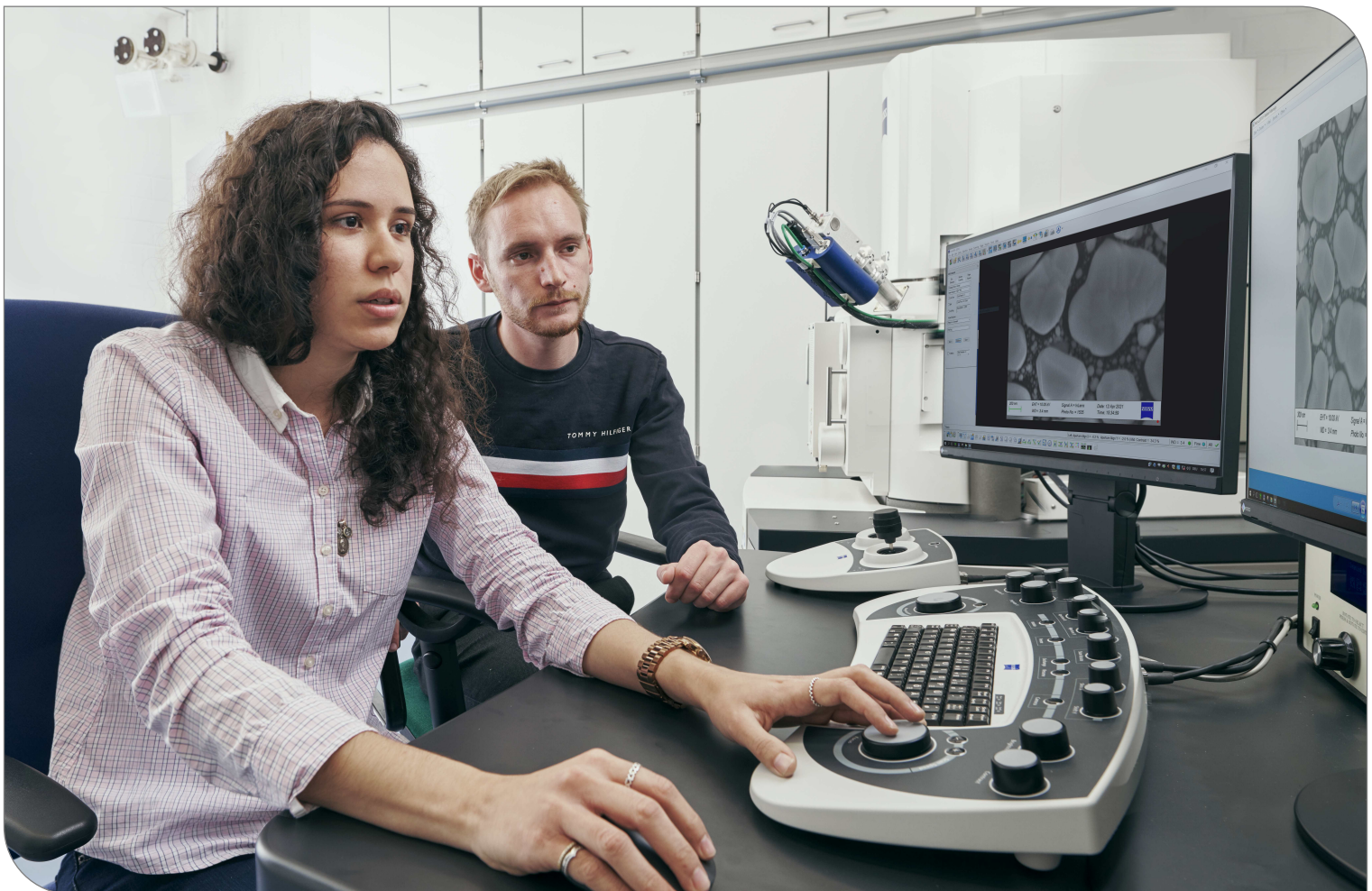
# Module Handbook Materials Science and Engineering Master 2017 (Master of Science (M.Sc.))

SPO 2017

Summer semester 2026

Date: 27/03/2026

KIT DEPARTMENT OF MECHANICAL ENGINEERING



## Table Of Contents

<b>1. General Information</b> .....	<b>6</b>
1.1. Study program details .....	6
<b>2. Qualification objectives</b> .....	<b>7</b>
<b>3. Studies plan</b> .....	<b>8</b>
<b>4. Study Program Structure</b> .....	<b>24</b>
4.1. Master's Thesis .....	24
4.2. Internship .....	24
4.3. Materials Science Major Course .....	24
4.4. Focal Course I .....	24
4.5. Focal Course II .....	25
4.6. Interdisciplinary Supplement .....	25
4.7. Interdisciplinary Qualifications .....	25
4.8. Additional Examinations .....	25
<b>5. Modules</b> .....	<b>26</b>
5.1. Computational Materials Science - M-MACH-103739 .....	26
5.2. Functional Materials - M-MACH-103741 .....	28
5.3. Internship - M-MACH-103838 .....	30
5.4. Key Competencies - M-MACH-103721 .....	31
5.5. Kinetics - M-MACH-103711 .....	32
5.6. Master's Thesis - M-MACH-103835 .....	34
5.7. Materials Characterization - M-MACH-103714 .....	35
5.8. Materials Processing - M-MACH-103740 .....	36
5.9. Properties - M-MACH-103713 .....	38
5.10. Simulation - M-MACH-103712 .....	39
5.11. Structural Materials - M-MACH-103738 .....	40
5.12. Supplementary Studies on Science, Technology and Society - M-FORUM-106753 .....	42
5.13. Technical Specialisation - M-MACH-103715 .....	46
5.14. Thermodynamics - M-MACH-103710 .....	48
<b>6. Module components</b> .....	<b>50</b>
6.1. Adaptive Optics - T-ETIT-107644 .....	50
6.2. Additive Manufacturing for Process Engineering - Examination - T-CIWVT-110902 .....	51
6.3. Additive Manufacturing of Metallic Components - T-MACH-113985 .....	52
6.4. Advanced Ceramic Processing - T-MACH-114753 .....	54
6.5. Applied Materials Simulation - T-MACH-110929 .....	55
6.6. Applied Materials Simulation - T-MACH-105527 .....	57
6.7. Applied Surface Materials - T-MACH-114646 .....	59
6.8. Applied Tribology in Industrial Product Development - T-MACH-105215 .....	60
6.9. Automotive Engineering I - T-MACH-102203 .....	61
6.10. Automotive Engineering I (in German) - T-MACH-100092 .....	63
6.11. Basic Molecular Cell Biology - T-CHEMBIO-105199 .....	65
6.12. Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113579 .....	66
6.13. Batteries and Fuel Cells - T-CHEMBIO-112316 .....	67
6.14. Batteries, Fuel Cells, and Electrolysis - T-ETIT-113986 .....	68
6.15. Batteries, Fuel Cells, and Electrolysis - Group Project - T-ETIT-114957 .....	69
6.16. Beyond Conventional Materials - Metamaterials & Architected Structures - T-MACH-113698 .....	70
6.17. Biomechanics: Design in Nature and Inspired by Nature - T-MACH-105651 .....	72
6.18. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I - T-MACH-100966 .....	73
6.19. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II - T-MACH-100967 .....	74
6.20. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III - T-MACH-100968 .....	76
6.21. CAE-Workshop - T-MACH-105212 .....	77
6.22. Combustion Engines I - T-MACH-102194 .....	79
6.23. Combustion Engines II - T-MACH-104609 .....	80
6.24. Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies - T-MACH-105535 .....	81
6.25. Computational Condensed Matter Physics - T-PHYS-109895 .....	83
6.26. Computational Elasticity - T-MACH-113989 .....	84
6.27. Computational Inelasticity - T-MACH-113990 .....	85
6.28. Computational Photonics, without ext. Exercises - T-PHYS-106131 .....	86

6.29. Constitution and Properties of Protective Coatings - T-MACH-105150 .....	87
6.30. Data Analytics for Engineers - T-MACH-105694 .....	89
6.31. Data Science and Scientific Workflows - T-MACH-111588 .....	91
6.32. Data Science and Scientific Workflows (Project) - T-MACH-111603 .....	93
6.33. Design of Highly Stressed Components - T-MACH-105310 .....	95
6.34. Drive System Engineering A: Automotive Systems - T-MACH-113405 .....	97
6.35. Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration - T-FORUM-113580 .....	98
6.36. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration - T-FORUM-113582 .....	99
6.37. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self- Registration - T-FORUM-113581 .....	100
6.38. Electromagnetics and Numerical Calculation of Fields - T-ETIT-100640 .....	101
6.39. Electron Microscopy I and II, with Exercises - T-PHYS-111915 .....	102
6.40. Electronic Properties of Solids I, without Exercises - T-PHYS-102578 .....	103
6.41. Electronic Properties of Solids II, without Exercises - T-PHYS-104423 .....	104
6.42. Energy Efficient and Sustainable Tribological Systems - T-MACH-114016 .....	105
6.43. Energy Efficient and Sustainable Tribological Systems (in German) - T-MACH-114015 .....	106
6.44. Energy Efficient Intralogistic Systems - T-MACH-105151 .....	108
6.45. Engineering Materials for the Energy Transition - T-MACH-112691 .....	109
6.46. Engineering Materials for the Energy Transition - T-MACH-109082 .....	110
6.47. Exercices - Tribology - T-MACH-114854 .....	111
6.48. Exercises for Applied Materials Simulation - T-MACH-110928 .....	113
6.49. Exercises for Applied Materials Simulation - T-MACH-107671 .....	115
6.50. Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria - T-MACH-107669 .....	117
6.51. Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria - T-MACH-110924 .....	119
6.52. Exercises for Materials Characterization - T-MACH-107685 .....	121
6.53. Exercises for Materials Characterization - T-MACH-110945 .....	122
6.54. Exercises for Microstructure-Property-Relationships - T-MACH-110930 .....	123
6.55. Exercises for Microstructure-Property-Relationships - T-MACH-107683 .....	124
6.56. Exercises for Solid State Reactions and Kinetics of Phase Transformations - T-MACH-107632 .....	125
6.57. Exercises for Solid State Reactions and Kinetics of Phase Transformations - T-MACH-110926 .....	126
6.58. Experimental Lab Class in Welding Technology, in Groups - T-MACH-102099 .....	127
6.59. Fabrication and Characterisation of Optoelectronic Devices - T-ETIT-103613 .....	129
6.60. Fabrication Processes in Microsystem Technology - T-MACH-102166 .....	130
6.61. Failure Analysis - T-MACH-114610 .....	131
6.62. Failure Analysis (in German) - T-MACH-105724 .....	133
6.63. Fatigue of Materials - T-MACH-112106 .....	135
6.64. Foundations of Nonlinear Continuum Mechanics - T-MACH-105324 .....	137
6.65. Foundry Technology - T-MACH-105157 .....	138
6.66. Fracture and Damage Mechanics - T-BGU-100087 .....	139
6.67. Fuels and Lubricants for Combustion Engines - T-MACH-105184 .....	140
6.68. Functional Ceramics - T-MACH-105179 .....	141
6.69. Functional Ceramics - T-MACH-114752 .....	142
6.70. Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria - T-MACH-110925 .....	144
6.71. Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria - T-MACH-107670 .....	146
6.72. Fundamentals in the Development of Commercial Vehicles - T-MACH-111389 .....	148
6.73. Fundamentals of Combustion I - T-MACH-114043 .....	151
6.74. Fundamentals of Combustion I (in German) - T-MACH-105213 .....	152
6.75. Fundamentals of Combustion II - T-MACH-114044 .....	154
6.76. Fundamentals of Combustion II (in German) - T-MACH-105325 .....	156
6.77. Fundamentals of Optics and Photonics - T-PHYS-103628 .....	158
6.78. Fundamentals of Optics and Photonics - Unit - T-PHYS-103630 .....	159
6.79. Fundamentals of Phase-Field Modelling - T-MACH-114627 .....	160
6.80. Fundamentals on Plasma Technology - T-ETIT-100770 .....	161
6.81. High Performance Computing - T-MACH-105398 .....	162
6.82. High Performance Powder Metallurgy Materials - T-MACH-102157 .....	164
6.83. High Temperature Corrosion - T-MACH-113598 .....	165
6.84. High Temperature Materials - T-MACH-105459 .....	167
6.85. Human Factors Engineering I (Workplace Design) - T-MACH-114175 .....	168
6.86. Human Factors Engineering II (Organizational Design) - T-MACH-114176 .....	170
6.87. Hybrid and Electric Vehicles - T-ETIT-100784 .....	171
6.88. Hydrogen as Energy Carrier - T-CHEMBIO-112317 .....	172

6.89. Hydrogen in Materials – Exercises and Lab Course - T-MACH-112159 .....	173
6.90. Hydrogen in Materials – Exercises and Lab Course (in German) - T-MACH-112942 .....	174
6.91. Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement - T-MACH-110923 .....	175
6.92. Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (in German) - T-MACH-110957 .....	177
6.93. Integrated Photonics - T-ETIT-114418 .....	179
6.94. Internship - T-MACH-107764 .....	180
6.95. Introduction to Bionics - T-MACH-111807 .....	181
6.96. Introduction to Microsystem Technology I - T-MACH-114100 .....	182
6.97. Introduction to Microsystem Technology II - T-MACH-114101 .....	183
6.98. Introduction to the Finite Element Method - T-MACH-105320 .....	184
6.99. Introduction to Theory of Materials - T-MACH-105321 .....	185
6.100. Lab Course in Failure Analysis - T-MACH-114609 .....	186
6.101. Laboratory Production Metrology - T-MACH-108878 .....	188
6.102. Laser Material Processing - T-MACH-112763 .....	190
6.103. Laser Metrology - T-ETIT-100643 .....	192
6.104. Laser-Assisted Methods and Their Application for Energy Storage Materials - T-MACH-106739 .....	193
6.105. Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113578 .....	196
6.106. Light and Display Engineering - T-ETIT-100644 .....	197
6.107. Lightweight Design Workshop: Simulation and Manufacturing - T-MACH-114439 .....	198
6.108. Master's Thesis - T-MACH-107759 .....	200
6.109. Materials and Processes for Electrochemical Storage - T-CIWVT-108146 .....	201
6.110. Materials Characterization - T-MACH-107684 .....	202
6.111. Materials Characterization - T-MACH-110946 .....	203
6.112. Materials in Additive Manufacturing - T-MACH-110165 .....	205
6.113. Materials Modelling: Dislocation Based Plasticity - T-MACH-105369 .....	206
6.114. Materials of Lightweight Construction - T-MACH-105211 .....	208
6.115. Materials Recycling and Sustainability - T-MACH-110937 .....	210
6.116. Mathematical Methods in Micromechanics - T-MACH-110378 .....	211
6.117. Measurement and Control Systems - T-MACH-103622 .....	212
6.118. Mechanical Properties of Nanomaterials and Microsystems - T-MACH-114018 .....	214
6.119. Mechanical Properties of Nanomaterials and Microsystems (in German) - T-MACH-114071 .....	216
6.120. Metal Forming - T-MACH-105177 .....	218
6.121. Micro Magnetic Resonance - T-MACH-105782 .....	220
6.122. Microstructure-Property-Relationships - T-MACH-110931 .....	221
6.123. Microstructure-Property-Relationships - T-MACH-107604 .....	223
6.124. Microsystem Simulation - T-MACH-108383 .....	225
6.125. Modern Characterization Methods for Materials and Catalysts - T-CHEMBIO-107822 .....	226
6.126. Multi-Scale Plasticity - T-MACH-105516 .....	227
6.127. Nano-Optics - T-PHYS-102282 .....	229
6.128. Non-destructive Materials Testing - T-MACH-114968 .....	230
6.129. Non-ferrous Metals and Alloys - T-MACH-114956 .....	232
6.130. Nonlinear Continuum Mechanics - T-MACH-111026 .....	233
6.131. Novel Actuators and Sensors - T-MACH-102152 .....	235
6.132. Optical Engineering and Machine Vision - T-ETIT-113941 .....	236
6.133. Optical Transmitters and Receivers - T-ETIT-100639 .....	237
6.134. Opto- and Nanoelectronic Devices - T-ETIT-114165 .....	238
6.135. Optoelectronic Components - T-ETIT-101907 .....	239
6.136. Organic and Flexible Electronics - T-ETIT-114638 .....	240
6.137. Particle Dynamics and Atomistic Simulation - T-MACH-114129 .....	241
6.138. Phase Transformations in Materials - T-MACH-111391 .....	243
6.139. Phase-Field Method in Thermomechanics - T-MACH-113694 .....	246
6.140. Photovoltaics - T-ETIT-101939 .....	247
6.141. Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle - T-MACH-105537 .....	248
6.142. Physics, Technology and Applications of Thin Films - T-ETIT-111237 .....	250
6.143. Plasticity of Metals and Intermetallics - T-MACH-110818 .....	251
6.144. Polymer Engineering I - T-MACH-102137 .....	253
6.145. Polymer Engineering II - T-MACH-102138 .....	255
6.146. Polymers in MEMS A: Chemistry, Synthesis and Applications - T-MACH-102192 .....	257
6.147. Polymers in MEMS B: Physics, Microstructuring and Applications - T-MACH-102191 .....	258
6.148. Polymers in MEMS C: Biopolymers and Bioplastics - T-MACH-102200 .....	259
6.149. Powertrain Systems Technology B: Stationary Machinery - T-MACH-105216 .....	261

6.150. Practical Course Technical Ceramics - T-MACH-105178 .....	262
6.151. Practical in Additive Manufacturing for Process Engineering - T-CIWVT-110903 .....	263
6.152. Practical Training in Basics of Microsystem Technology - T-MACH-102164 .....	264
6.153. Principles of Ceramic and Powder Metallurgy Processing - T-MACH-102111 .....	266
6.154. Product- and Production-Concepts for Modern Automobiles - T-MACH-110318 .....	267
6.155. Product Lifecycle Management - T-MACH-105147 .....	269
6.156. Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components - T-MACH-113575 .....	270
6.157. Quality Management - T-MACH-102107 .....	272
6.158. Rail System Technology - T-MACH-106424 .....	274
6.159. Rail Vehicle Technology - T-MACH-105353 .....	276
6.160. Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society - T-FORUM-113587 .....	278
6.161. Robotics I - Introduction to Robotics - T-INFO-108014 .....	279
6.162. Scientific Computing for Engineers - T-MACH-100532 .....	281
6.163. Self-Booking-MSc-HOC-SPZ-FORUM-Graded - T-MACH-112687 .....	283
6.164. Self-Booking-MSc-HOC-SPZ-FORUM-Graded - T-MACH-113322 .....	284
6.165. Self-Booking-MSc-HOC-SPZ-FORUM-Graded - T-MACH-113324 .....	285
6.166. Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded - T-MACH-113321 .....	286
6.167. Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded - T-MACH-113323 .....	287
6.168. Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded - T-MACH-112686 .....	288
6.169. Seminar "Materials Modelling" - T-MACH-107660 .....	289
6.170. Seminar Materials Simulation - T-MACH-113814 .....	291
6.171. Sensor Systems - T-ETIT-100709 .....	293
6.172. Sensors - T-ETIT-101911 .....	294
6.173. Simulation of Nanoscale Systems, without Seminar - T-PHYS-102504 .....	295
6.174. Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures - T-MACH-105971 .....	296
6.175. Single-Photon Detectors - T-ETIT-108390 .....	298
6.176. Solar Energy - T-ETIT-100774 .....	299
6.177. Solar Thermal Energy Systems - T-MACH-106493 .....	300
6.178. Solid State Reactions and Kinetics of Phase - T-MACH-107667 .....	302
6.179. Solid State Reactions and Kinetics of Phase Transformations - T-MACH-110927 .....	304
6.180. Solid-State Optics, without Exercises - T-PHYS-104773 .....	306
6.181. Structural and Phase Analysis - T-MACH-102170 .....	307
6.182. Superconducting Magnet Technology - T-ETIT-113440 .....	308
6.183. Superconducting Materials Lab - T-ETIT-114730 .....	309
6.184. Superconducting Materials Lecture - T-ETIT-114729 .....	310
6.185. Superconducting Nanowire Detectors - T-ETIT-111236 .....	311
6.186. Superconducting Power Systems - T-ETIT-113439 .....	312
6.187. Superconductivity for Engineers - T-ETIT-111239 .....	313
6.188. Superhard Thin Film Materials - T-MACH-102103 .....	314
6.189. Superhard Thin Film Materials - T-MACH-111257 .....	316
6.190. Sustainable Vehicle Drivetrains - T-MACH-111578 .....	318
6.191. Technology of Steel Components - T-MACH-105362 .....	319
6.192. The ABC of DFT - T-PHYS-105960 .....	321
6.193. Theoretical Quantum Optics - T-PHYS-110303 .....	322
6.194. Thermal Turbomachines I - T-MACH-105363 .....	323
6.195. Thermal Turbomachines II - T-MACH-105364 .....	324
6.196. Thermophysics of Advanced Materials - T-MACH-111459 .....	326
6.197. Thin Films – Structure, Thermodynamics, Applications in Energy Technologies - T-MACH-114014 .....	329
6.198. Tribology - T-MACH-114853 .....	330
6.199. Turbo Jet Engines - T-MACH-105366 .....	332
6.200. Tutorial Computational Elasticity - T-MACH-114529 .....	334
6.201. Tutorial Computational Inelasticity - T-MACH-114530 .....	335
6.202. Tutorial Introduction to the Finite Element Method - T-MACH-110330 .....	336
6.203. Tutorial Mathematical Methods in Micromechanics - T-MACH-110379 .....	337
6.204. Tutorial Nonlinear Continuum Mechanics - T-MACH-111027 .....	338
6.205. Vehicle Lightweight Design - Strategies, Concepts, Materials - T-MACH-105237 .....	339
6.206. Vibration Theory - T-MACH-105290 .....	341
6.207. Welding Technology - T-MACH-105170 .....	343
6.208. Windpower - T-MACH-105234 .....	345
<b>7. Studies and examination regulations .....</b>	<b>346</b>

## 1 General Information

### 1.1 Study program details

<b>KIT-Department</b>	KIT Department of Mechanical Engineering
<b>Academic Degree</b>	Master of Science (M.Sc.)
<b>Examination Regulations Version</b>	2017
<b>Regular semesters</b>	4 semesters
<b>Maximum semesters</b>	7 semesters
<b>Credits</b>	120
<b>Language</b>	
<b>Grade calculation</b>	Weighted average by credits
<b>Additional Information</b>	Link to study program <a href="http://www.mach.kit.edu/MatWerk.php">www.mach.kit.edu/MatWerk.php</a>

### 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 2017  
(PO-Version 2017)**

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

### Contents

0.	List of Abbreviations .....	2
1.	Studies Plans, Modules, and Examinations .....	3
1.1.	Examinations .....	3
1.2.	Modules in the Master's Program .....	3
1.3.	Studies Plan of the Master's Program "M.Sc." .....	5
1.4.	Options of Courses in the module Technical Specialization of the subject Interdisciplinary Supplement.....	7
1.5.	Master's Thesis Module.....	9
2.	Internship.....	9
2.1.	Contents and Organization of the Internship.....	9
2.2.	Recognition of the Internship.....	9
3.	Focal Courses .....	10
3.1.	Scope and Structure .....	10
3.2.	Focal Courses (SP) and corresponding options.....	11

### History of Revisions (from 01.10.2020)

Date	Revision made
15.03.2021	Update of courses in the focal courses
24.09.2021	Update of courses in the focal courses
30.03.2022	Update of courses and examinations in the module Technical Specialization and in the focal courses
02.09.2022	Update of courses in the module Technical Specialization and in the focal courses
26.01.2023	Update of courses in the focal courses
28.06.2023	Update of courses in the focal courses
12.03.2024	Update of courses in the focal courses
03.09.2024	Update of courses in the module Technical Specialization and in the focal courses
24.02.2025	Update of courses in the module Technical Specialization and in the focal courses
15.09.2025	Update of courses in the module Technical Specialization and in the focal courses
03.03.2026	Update of courses in the module Technical Specialization and in the focal courses

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2017, Decision by the KIT Department Council of November 27, 2019 with editorial revisions, valid from 01.04.2022

1/16

## 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).

The subject of "Überfachliche Qualifikationen" (transferable skills) described in Articles 15 a and 19, par. 2 of the Studies and Examination Regulations covers of the "Schlüsselqualifikationen" (key competences) module, within which 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 4 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 (Thermodynamics)	Thermodynamische Grundlagen / Heterogene Gleichgewichte Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria	Seifert	6	SL, mPr	6
2 Kinetik (Kinetics)	Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion Solid-state Reactions and Kinetics of Phase Transformations, Corrosion	Seifert	6	SL, mPr	6
3 Simulation (Simulation)	Angewandte Werkstoffsimulation Applied Materials Simulation	Gumbsch	6	SL, mPr	6
4 Eigenschaften (Properties)	Gefüge-Eigenschafts-Beziehungen Microstructure-Property Relationships	Kirchlechner	6	SL, mPr	6
5 Werkstoffanalytik (Materials Characterization)	Werkstoffanalytik Materials Characterization	Pundt	6	SL, mPr	6
6 Schwerpunkt I (Focal Course I)	Cf. section 3		16	mPr	16
7 Schwerpunkt II (Focus Course II)	Cf. section 3		16	mPr	16
8 Technische Vertiefung (Technical Specialisation)	See 1.4		12	m/sPr	12
9 Schlüsselqualifikationen (Key competences)	HoC/SPZ/FORUM courses		4	SL*	0

In modules 1-5, all partial achievements are offered in both English and German.

In modules 6-9, 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:

Semester	WS 1	SS 2	WS 3	SS 4	Total 120 LP
Subject	32 LP	30 LP	28 LP	30 LP	
Materialwiss. Vertiefung	Thermodynamische Grundlagen / Heterogene Gleichgewichte  6 LP, mPr  Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion  6 LP, mPr	Angewandte Werkstoffsimulation  6 LP, mPr  Gefüge- Eigenschafts- Beziehungen  6 LP, mPr  Werkstoffanalytik  6 LP, mPr		Masterarbeit 30 LP	30 LP
Schwerpunkt I *	Siehe 3.2 8 LP, 2 mPr	Siehe 3.2 8 LP, 2 mPr			16 LP
Schwerpunkt II *			Siehe 3.2 16 LP, 3 mPr		16 LP
Interdisziplinäre Ergänzung		Siehe 1.4 4 LP, m/sPr	Siehe 1.4 8 LP, m/sPr		12 LP
Überfachliche Qualifikationen			HoC/SPZ/FORUM- Veranst. 4 LP, SL		4 LP
	Berufspraktikum 12 LP				12 LP

\* Selection of two from four possible focal courses according to Section 3. The precise amount of credits per semester depends on the courses chosen.

Plan of studies in English throughout:

Semester	WS 1	SS 2	WS 3	SS 4	Total 120 credits
Subject	32 credits	30 credits	28 credits	30 credits	
Materialwiss. Vertiefung (Materials Science Major Course)	Microstructure- Property Relationships 6 credits, mPr  Materials Characterization 6 credits, mPr	Applied Materials Modeling 6 credits, mPr  Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria 6 credits, mPr  Solid-state Reactions and Kinetics of Phase Transformations, Corrosion 6 credits, mPr		Master's thesis 30 credits	30 credits
Schwerpunkt I * (Focal Course I)	See 3.2 8 credits, 2 mPr	See 3.2 8 credits, 2 mPr			16 credits
Schwerpunkt II * (Focal Course II)			See 3.2 16 credits, 3 mPr		16 credits
Interdisziplinäre Ergänzung (Interdisciplinary Supplement)		See 1.4 4 credits, m/sPr	See 1.4 8 credits, m/sPr		12 credits
Überfachliche Qualifikationen (Interdisciplinary Qualifications)			HoC/SPZ/FORUM- courses 4 credits, SL		4 credits
	Internship 12 credits				12 credits

\* Selection of two from four possible focal courses according to Section 3. The precise amount of credits per semester depends on the courses chosen.

#### 1.4. Options of Courses in the module Technical Specialization of the subject Interdisciplinary Supplement

Course number	Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2306321+ 2306323	Hybride und elektrische Fahrzeuge	Doppelbauer, Richter	3	4	sPr	WS	D
2147175	CAE-Workshop	Albers	3	4	PA	WS/SS	D
2146180	Antriebssystemtechnik A: Fahrzeugantriebstechnik	Albers	2	4	sPr	SS	D
2145150	Antriebssystemtechnik B: Stationäre Antriebssysteme	Albers	2	4	sPr	WS	D
2117500	Energieeffiziente Intralogistiksysteme	Schönung	2	4	mPr	WS	D
2145181	Angewandte Tribologie in der industriellen Produktentwicklung	Albers	2	4	mPr	WS	D
2181114	Tribologie	Scherge/ Dienwiebel	5	8	mPr	WS	D
2113805	Grundlagen der Fahrzeugtechnik I*	Gauterin	4	8	sPr	WS	D
2113809	Automotive Engineering I*	Gauterin/ Gießler	4	8	sPr	WS	E
2113812 + 2114844	Grundsätze der Nutzfahrzeugentwicklung I+II	Zürn	2	4	mPr	WS/SS	D
2149670	Produkt- und Produktionskonzepte für moderne Automobile	Steegmüller, Kienzle	2	4	mPr	WS	D
2133113	Verbrennungsmotoren I	Kubach	2	4	mPr	WS	D
2134151	Verbrennungsmotoren II	Kubach	3	5	mPr	SS	D
2133108	Betriebsstoffe für motorische Antriebe	Kehrwald	2	4	mPr	WS	D
2189906	Physikalische und chemische Grundlagen der Kernenergie im Hinblick auf Reaktorstörfälle und nukleare Entsorgung	Dagan, Metz	1	2	mPr	WS	D
2189400	Solar Thermal Energy Systems	Dagan	2	4	mPr	WS	E
2157381	Windkraft	Lewald	2	4	sPr	WS	D
2165515+ 2165517	Grundlagen der technischen Verbrennung I*	Fischlschweiger	3	4	mPr	WS	D
2166538+ 2166589	Grundlagen der technischen Verbrennung II	Fischlschweiger	3	4	mPr	SS	D
3165016+ 3165017	Fundamentals of Combustion I*	Fischlschweiger	2+1	4	sPr	WS	E
3166550+ 3166551	Fundamentals of Combustion II*	Fischlschweiger	2+1	4	mPr	SS	E
2170478	Turbinen-Luftstrahl-Triebwerke	Bauer	2	4	mPr	SS	D
2424152	Robotik I – Einführung in die Robotik	Asfour	4	6	sPr	WS	D
2109031	Human Factors Engineering I (Workplace)	Deml	2	4	sPr	WS	E

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2017, Decision by the KIT Department Council of November 27, 2019 with editorial revisions, valid from 01.04.2022

7/16

	Design)						
2109032	Human Factors Engineering II (Organizational Design)	Deml	2	4	sPr	WS	E
2149667	Qualitätsmanagement	Lanza	2	4	sPr	WS	D
2115919	Bahnsystemtechnik	Gratzfeld	2	4	mPr	WS/SS	D
2115996	Schienefahrzeugtechnik	Gratzfeld	2	4	mPr	WS/SS	D
2133132	Nachhaltige Fahrzeugantriebe	Toedter	2	4	mPr	WS	D
2106014	Datenanalyse für Ingenieure	Mikut, Reischl	3	5	sPr	SS	D
2169453+ 2169454	Thermische Turbomaschinen I*	Bauer	5	6	mPr	WS	D
2169553+ 2169454	Thermische Turbomaschinen I (auf Englisch) *	Bauer	5	6	mPr	WS	E
2170476+ 2170477	Thermische Turbomaschinen II*	Bauer	3	6	mPr	SS	D
2170553+ 2170477	Thermische Turbomaschinen II (auf Englisch) *	Bauer	5	6	mPr	SS	E
2121350	Product Lifecycle Management	Ovtcharova	2	4	sPr	WS	D
2161212+ 2161213	Technische Schwingungslehre	Fidlin	4	5	sPr	WS	D
2143882	Fertigungsprozesse der Mikrosystem-technik	Bade	2	4	mPr	WS/SS	D
2141864	BioMEMS-Mikrosystemtechnik für Life-Sciences und Medizin: I	Guber	2	4	mPr	WS	D
2142883	BioMEMS-Mikrosystemtechnik für Life-Sciences und Medizin: II	Guber	2	4	mPr	SS	D
2142879	BioMEMS-Mikrosystemtechnik für Life-Sciences und Medizin: III	Guber	2	4	mPr	SS	D
2125763	Struktur- und Phasenanalyse	Wagner	2	4	mPr	WS	D
4027111+2 4027021+2	Elektronenmikroskopie I+II (mit Übungen)	Eggeler	8	16	mPr	SS/WS	D
2142140	Bionik für Ingenieure und Naturwissenschaftler	Hölscher	2	4	mPr	SS	D
2313760	Fabrication and Characterisation of Optoelectronic Devices	Richards	2	3	sPr	SS	E
4044021+ 4044022	Fundamentals of Optics and Photonics	Hunger	6	8	sPr	WS	E
7148	Basic Molecular Cell Biology	Weth	2	2	sPr	SS	E
3137020 + 3137021	Measurement and Control Systems	Stiller	4	6	sPr	WS	E
2141853	Polymers in MEMS A - Chemistry, Synthesis and Applications	Rapp	2	4	mPr	WS	D/E
2141854	Polymers in MEMS B - Physics, Manufacturing and Applications	Worgull	2	4	mPr	WS	D/E
2142855	Polymers in MEMS C - Biopolymers and	Worgull	2	4	mPr	SS	D/E

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2017, Decision by the KIT Department Council of November 27, 2019 with editorial revisions, valid from 01.04.2022

	Bioplastics						
--	-------------	--	--	--	--	--	--

- \* The following courses cannot be combined:
- Grundlagen der Fahrzeugtechnik I and Automotive Engineering I
  - Grundlagen der technischen Verbrennung I and Fundamentals of Combustion I
  - Thermische Turbomaschinen I and Thermische Turbomaschinen I (auf Englisch)
  - Thermische Turbomaschinen II and Thermische Turbomaschinen II (auf Englisch)

### 1.5. 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 (Praktikantenzugnis) 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. Focal Courses

### 3.1. Scope and Structure

In the master's program, two different Schwerpunkte (focuses) have to be chosen, in which at least 16 credits each are acquired. The amount of 16 credits may be exceeded once only by registration of a partial achievement. It is not permitted to register additional partial achievements, if 16 credits have already been exceeded. Within a focus, at least 12 credits must be acquired by graded controls of success and at least 8 credits must be chosen from courses marked by "X". The focus grade is calculated from the completed graded partial modules.

In any case, all partial module grades are weighed according to their credits when determining the focus grade. When calculating the total grade, every focus is evaluated with 16 credits.

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 focal course should not be transferred to another focal course.

## 3.2. Focal Courses (SP) and corresponding options

## SP1: Konstruktionswerkstoffe (Structural Materials)

Coordinator: Professor Heilmaier

Course number		Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2126730	X	Advanced Ceramic Processing	Furlan	2	4	mPr	WS	E
2125751		Praktikum "Technische Keramik"	Schell	2	4	SL	WS	D
2126749	X	Pulvermetallurgische Hochleistungswerkstoffe	Schell	2	4	mPr	SS	D
2173586	X	Schwingfestigkeit	Guth	2	4	mPr	SS	D
2174574	X	Werkstoffe für den Leichtbau	Liebig	2	4	mPr	SS	D
2174579	X	Technologie der Stahlbauteile	Schulze	2	4	mPr	SS	D
2177618	X	Superharte Dünnschichtmaterialien*	Ulrich	2	4	mPr	WS	D
2194729	X	Superhard Thin Film Materials*	Ulrich	2	4	mPr	SS	E
2113102	X	Fahrzeuleichtbau – Strategien, Konzepte, Werkstoffe	Henning	2	4	sPr	WS	D
2114053	X	Faserverstärkte Kunststoffe - Polymere, Fasern, Halbzeuge, Verarbeitung	Henning	2	4	sPr	SS	D
2182100	X	Energieeffiziente und nachhaltige tribologische Systeme	Dienwiebel	2	4	mPr	SS	D
Neu	X	Energy Efficient and Sustainable Tribological Systems	Dienwiebel	2	4	mPr	WS	E
2181745		Auslegung hochbelasteter Bauteile	Aktaa	2	4	mPr	WS	D
2193055	X	High Temperature Corrosion	Gorr	2	4	mPr	WS	E
2181750		Plastizität auf verschiedenen Skalen	Schulz/Greiner	2	4	PA	WS	D
2182572	X	Schadenskunde	Schneider/Greiner	2	4	mPr	WS	D
2182102	X	Failure Analysis	Bauer	2	4	mPr	SS	E
2182101		Praktikum zur Schadenskunde	Greiner	2	4	SL	SS	D
2181708		Biomechanik: Design in der Natur und nach der Natur	Mattheck	2	4	SL	WS	D
2173583	X	Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement**	Pundt	2	4	mPr	SS	E
2173584	X	Hydrogen in Materials: Exercises and Lab Course***	Wagner	1	4	SL	SS	E
2174572	X	Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung**	Pundt	2	4	mPr	WS	D
2174573	X	Wasserstoff in Materialien: Übungen und Laborkurs***	Wagner	2	4	SL	WS	D
2173600	X	Werkstoffe in der additiven Fertigung	Dietrich	2	4	mPr	WS	D
2174512	X	Zerstörungsfreie Materialprüfung	Dietrich	4	6	mPr	SS	D
2173648	X	Plasticity of Metals and Intermetallics	Kauffmann	4	8	mPr	SS	E
2174605	X	High Temperature Materials	Heilmaier	2	4	mPr	WS	E
neu	X	Thin Films – Structure, Thermodynamics, Applications in Energy Technologies	Wagner	2	4	mPr	SS	E
2193051	X	Thermophysics of Advanced Materials	Sergeev	2	4	mPr	ww	E
2173421	X	Phase Transformations in Materials	Heilmaier/ Kauffmann	2	4	mPr	WS	E
2174555	X	Non-ferrous Metals and Alloys	Heilmaier	3	4	mPr	SS	E
2186100	X	Jenseits konventioneller Werkstoffe - Metamaterialien und 3D strukturierte Bauteile	Bauer	2	4	mPr	WS	E

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2017, Decision by the KIT Department Council of November 27, 2019 with editorial revisions, valid from 01.04.2022

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

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: Materialprozesstechnik (Materials Processing)

Coordinator: Professor Schulze

Course number		Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2174575		Gießereikunde	Klan/Günther	2	4	sPr	SS	D
2173571		Schweißtechnik	Farajian	2	4	mPr	WS	D
2173590	X	Polymerengineering I	Elsner	2	4	mPr	WS	D
2174596	X	Polymerengineering II	Elsner	2	4	mPr	SS	D
2193010	X	Grundlagen der Herstellungsverfahren der Keramik und Pulvermetallurgie	Schell	2	4	mPr	WS	D
2245840		Materialien für elektrochemische Speicher und Wandler	Tübke	2	4	mPr	WS/SS	D
2177601	X	Aufbau und Eigenschaften von Schutzschichten	Ulrich	2	4	mPr	WS	D
2182642	X	Laser Material Processing	Schneider	2	4	mPr	SS	E
2150681		Umformtechnik	Herlan	2	4	mPr	SS	D
2173560		Experimentelles schweißtechnisches Praktikum, in Gruppen	Schulze / Dietrich	3	4	SL	WS	D
2173520	X	Werkstoffrecycling und Nachhaltigkeit	Liebig	2	4	mPr	SS	D
2113111	X	Leichtbau-Workshop: Simulation und Fertigung	Kärger/Liebig	2	4	mPr	WS	D
2114107	X	Simulation der Prozesskette kontinuierlich verstärkter Faserverbundbauteile	Kärger	2	4	mPr	SS	D
2149671	X	Additive Fertigung metallischer Bauteile	Zanger	2	4	mPr	WS	D
2150704	X	Projektpraktikum Additive Fertigung: Designoptimierung und Herstellung metallischer Bauteile	Zanger	3	4	PA	SS	D
2150550		Praktikum Produktionsintegrierte Messtechnik	Lanza	3	4	PA	SS	D
22929 + 22930	X	Additive Manufacturing for Process Engineering + Practical	Klahn	3	6	mPr	SS	E
2141861	X	Introduction to Microsystem Technology I	Korvink	2	4	sPr	WS	E
2142874	X	Introduction to Microsystem Technology II	Korvink	2	4	sPr	SS	E
2301478	X	Laser Metrology	Eichhorn	2	3	mPr	SS	E
2141501	X	Mikro NMR Technologie	Korvink	2	4	PA	WS	E
2302150+ 2302151	X	Optical Engineering and Machine Vision	Heizmann	4	6	sPr	WS	E

## SP4: Funktionswerkstoffe (Functional Materials)

Coordinator: Professor Ehrenberg

Course number		Course	Lecturer	SWS	Credits	Control of success	Sem	Language
2304240+ 2304241	X	Batteries, Fuel Cells, and Electrolysis*	Krewer	4	6	sPr	WS	E
2304231	X	Sensoren	Menesklou	2	3	sPr	WS	D
2304240	X	Sensorsysteme	Wersing	2	3	mPr	SS	D
2313737	X	Photovoltaik**	Powalla	4	6	sPr	SS	D
2313734		Grundlagen der Plasmatechnologie	Kling	2	4	mPr	SS	D
2141865	X	Neue Aktoren und Sensoren	Kohl / Sommer	2	4	mPr	WS	D
4021011	X	Elektronische Eigenschaften von Festkörpern I	Weber / Weiß	4	8	mPr	WS	D
4021111		Elektronische Eigenschaften von Festkörpern II	Ustinov	2	4	mPr	SS	D
5439		Moderne Charakterisierungsmethoden zur Charakterisierung von Materialien und Katalysatoren	Grunwaldt / Kleist / Lichtenberg	2	4	mPr	WS	D
2313770+ 2313771	X	Bauelemente der Opto- und Nanoelektronik	Lemmer	4	6	sPr	SS	D
2126784	X	Funktionskeramiken***	Botros	2	4	mPr	WS	D
2125740	X	Functional Ceramics***	Furlan	2	4	mPr	WS	E
2177013	X	Mechanische Eigenschaften von Nanomaterialien und Mikrosystemen****	Gruber/ Kirchlechner/ Weygand	2	4	mPr	WS	D
2178420	X	Mechanical Properties of Nanomaterials and Microsystems****	Gruber/ Kirchlechner/ Weygand	2	4	mPr	SS	E
2143875	X	Praktikum zu Grundlagen der Mikrosystemtechnik	Last	2	3	sPr	ww	D
2312717	X	Superconducting Materials Lecture*****	Holzapfel	2	3	mPr	WS	E
2312696	X	Superconducting Materials Lab*****	Holzapfel	2	3	PA	SS	E
2312708 +2312709	X	Superconductivity for Engineers*****	Holzapfel/ Kempf	3	5	sPr	WS/ SS	E
2312698	X	Superconducting Magnet Technology	Arndt	3	4	mPr	SS	E
2314011	X	Superconducting Power Systems	Noe	3	4	mPr	WS	E
2193013		Lasergestützte Methoden und deren Einsatz für Energiespeichermaterialien	Pfleging	2	4	mPr	ww	D
2193007	X	Materialien und Werkstoffe für die Energiewende*****	Seifert	2	4	mPr	WS	D
2193008	X	Engineering Materials for the Energy Transition*****	Franke/Seifert	2	4	mPr	SS	E
2313768	X	Organic and Flexible Electronics	Hernandes Sosa	2	3	mPr	WS	E
5072	X	Batteries and Fuel Cells*	Ehrenberg / Scheiba	2	4	mPr	WS	E
5073	X	Hydrogen as Energy Carrier	Ehrenberg / Leon	2	4	mPr	WS	E
2309440+ 2309441	X	Integrated Photonics	Koos	4	6	mPr	WS	E
2181550	X	Applied Surface Materials	Benayad	2	4	mPr	WS	E
2313745+ 2313750	X	Solar Energy**	Richards	4	6	sPr	WS	E
4020011	X	Solid State Optics	Hetterich	4	8	mPr	WS	E
2312680+ 2312694	X	Single-Photon-Detectors	Illin	3	4	mPr	WS	E
4020021+	X	Nano Optics	Naber	4	8	mPr	WS	E

Studies plan of the KIT Department of Mechanical Engineering for the Master's Program of Materials Science and Engineering SPO2017, Decision by the KIT Department Council of November 27, 2019 with editorial revisions, valid from 01.04.2022

15/16

### 3 STUDIES PLAN

4020022								
2309486+ 2309487	X	Optoelectronic Components	Freude	3	4	mPr	SS	E
4023011+ 4023012	X	Theoretical Quantum Optics	Rockstuhl	3	6	mPr	WS	E
2313724	X	Adaptive Optics	Gladysz	2	3	mPr	WS	E
2313747+ 2313749	X	Light and Display Engineering	Kling	3	4	mPr	WS	E
2309460+ 2309461	X	Optical Transmitters and Receivers	Freude	4	6	mPr	WS	E
2312710+ 2312711	X	Physics, Technology and Applications of Thin Films	Illin	2+1	4	mPr	WS	E
2312671	X	Superconducting Nanowire Detectors	Illin	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 "Solar Energy" and "Photovoltaik" (photovoltaics) 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.
- \*\*\*\*\* The partial achievements "Superconducting Materials Lecture" and "Superconducting Materials Lab" cannot be taken in combination with "Superconductivity for Engineers" 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.

## 4 Study Program Structure

Mandatory	
Master's Thesis	30 CP
Internship	12 CP
Materials Science Major Course	30 CP
Focal Course I	16 CP
Focal Course II	16 CP
Interdisciplinary Supplement	12 CP
Interdisciplinary Qualifications	4 CP
Voluntary	
Additional Examinations <i>This field will not influence the calculated grade of its parent.</i>	

### 4.1 Master's Thesis

**Credits**  
30

Mandatory				
M-MACH-103835	Master's Thesis	DE	WS+SS	30 CP

### 4.2 Internship

**Credits**  
12

Mandatory				
M-MACH-103838	Internship	DE	WS+SS	12 CP

### 4.3 Materials Science Major Course

**Credits**  
30

Mandatory				
M-MACH-103710	Thermodynamics	DE/EN	WS+SS	6 CP
M-MACH-103711	Kinetics	DE/EN	WS+SS	6 CP
M-MACH-103712	Simulation	DE/EN	SS	6 CP
M-MACH-103713	Properties	DE/EN	WS+SS	6 CP
M-MACH-103714	Materials Characterization	DE/EN	WS+SS	6 CP

### 4.4 Focal Course I

**Credits**  
16

Focal Course I (Election: 1 item)				
M-MACH-103738	Structural Materials	DE	WS+SS	16 CP
M-MACH-103739	Computational Materials Science	DE	WS+SS	16 CP
M-MACH-103740	Materials Processing	DE	WS+SS	16 CP
M-MACH-103741	Functional Materials	DE	WS+SS	16 CP

**4.5 Focal Course II****Credits**  
16

<b>Focal Course II (Election: 1 item)</b>				
M-MACH-103738	Structural Materials	DE	WS+SS	16 CP
M-MACH-103739	Computational Materials Science	DE	WS+SS	16 CP
M-MACH-103740	Materials Processing	DE	WS+SS	16 CP
M-MACH-103741	Functional Materials	DE	WS+SS	16 CP

**4.6 Interdisciplinary Supplement****Credits**  
12

<b>Mandatory</b>				
M-MACH-103715	Technical Specialisation	DE	WS+SS	12 CP

**4.7 Interdisciplinary Qualifications****Credits**  
4

<b>Mandatory</b>				
M-MACH-103721	Key Competencies	DE	WS+SS	4 CP

**4.8 Additional Examinations**

<b>Additional Examinations (Election: at most 30 credits)</b>				
M-FORUM-106753	Supplementary Studies on Science, Technology and Society <i>First usage possible from Oct 01, 2024.</i>	DE	WS+SS	16 CP

## 5 Modules

### M

## 5.1 Module: Computational Materials Science [M-MACH-103739]

**Coordinators:** Prof. Dr. Britta Nestler  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [Focal Course I](#)  
[Focal Course II](#)

**Credits**  
16 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
10

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

### Assessment

The success controls usually include an "Alternative academic assessment" in the form of a seminar paper including a presentation (obligatory course "Seminar Materials Modelling") as well as two 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: 90 h

preparation and rework time: 390 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: Functional Materials [M-MACH-103741]

**Coordinators:** Prof. Dr. Helmut Ehrenberg  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Focal Course I  
 Focal Course II

Credits	Grading	Recurrence	Duration	Language	Level	Version
16 CP	graded	Each term	2 terms	German	4	16

Compulsory Elective Studies "X" (Election: at least 8 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-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-CHEMBIO-112317	Hydrogen as Energy Carrier	4 CP	Ehrenberg
T-ETIT-114418	Integrated Photonics	6 CP	Koos
T-ETIT-100644	Light and Display Engineering	4 CP	Kling
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-PHYS-102282	Nano-Optics	8 CP	Naber
T-MACH-102152	Novel Actuators and Sensors	4 CP	Kohl, Sommer
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-102164	Practical Training in Basics of Microsystem Technology	3 CP	Last
T-ETIT-101911	Sensors	4 CP	Schröder
T-ETIT-100709	Sensor Systems	4 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
Compulsory Elective Studies PL without "X" (Election: )			

T-PHYS-104423	Electronic Properties of Solids II, without Exercises	4 CP	Le Tacon, Rotzinger, Ustinov, Wernsdorfer
T-ETIT-100770	Fundamentals on Plasma Technology	4 CP	Kling
T-MACH-106739	Laser-Assisted Methods and Their Application for Energy Storage Materials	4 CP	Pfleging
T-CHEMBIO-107822	Modern Characterization Methods for Materials and Catalysts	4 CP	

**Assessment**

The success controls usually include four 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 acquire 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: 90 h

preparation and rework time: 390 h

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

**Recommendations**

Good physical and electrical basic knowledge

**Teaching and Learning Methods**

Lectures, Lab Courses, Seminars

Level 4

## M

**5.3 Module: Internship [M-MACH-103838]**

**Coordinators:** Dr. Patric Gruber  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [Internship](#)

**Credits**  
12 CP

**Grading**  
pass/fail

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
1

Mandatory			
T-MACH-107764	<a href="#">Internship</a>	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 § 14a. 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: 9 weeks x 40 h/week = 360 h

**Teaching and Learning Methods**

Professional practical training

## M

**5.4 Module: Key Competencies [M-MACH-103721]**

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

**Credits**  
4 CP

**Grading**  
pass/fail

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
2

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
T-MACH-113323	Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded	1 CP	Pundt
T-MACH-113324	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

**5.5 Module: Kinetics [M-MACH-103711]**

**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr  
Prof. Dr. Hans Jürgen Seifert  
Dr. Christopher Stihl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [Materials Science Major Course](#)

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

**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.

<b>Compulsory Elective Subjects (Election: 2 items as well as 6 credits)</b>			
T-MACH-107632	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations</a>	2 CP	Gorr, Stihl
T-MACH-107667	<a href="#">Solid State Reactions and Kinetics of Phase</a>	4 CP	Gorr, Stihl
T-MACH-110926	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations</a>	2 CP	Gorr
T-MACH-110927	<a href="#">Solid State Reactions and Kinetics of Phase Transformations</a>	4 CP	Gorr

**Assessment**

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

**Prerequisites**

none

**Competence Goal**

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

**Content**

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

**Module Grade Calculation**

The module grade is equal to the grade of the oral exam.

**Additional Information**

The participation in Exercises for Solid State Reactions and Kinetics of Phase Transformations is obligatory.

**Workload**

The workload for the module "Kinetics" is 180 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 (99 h) and for the tutorials (48 h).

**Recommendations**

- Basic course in materials science and engineering
- Basic course in mathematics
- physics or physical chemistry

Knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert).

**Teaching and Learning Methods**

Lectures (Obligatory)

Tutorials (Obligatory)

**Literature**

1. J. Crank, „The Mathematics of Diffusion“, 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, „Atom Movements“, Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, „Phase Transformations in Metals and Alloys“, 3rd edition, CRS Press, 2009.
4. H. Mehrer, „Diffusion in Solids“, Springer, Berlin, 2007.

## M

**5.6 Module: Master's Thesis [M-MACH-103835]**

**Coordinators:** Prof. Dr. Astrid Pundt  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [Master's Thesis](#)

<b>Credits</b> 30 CP	<b>Grading</b> graded	<b>Recurrence</b> Each term	<b>Duration</b> 1 term	<b>Language</b> German	<b>Level</b> 4	<b>Version</b> 3
-------------------------	--------------------------	--------------------------------	---------------------------	---------------------------	-------------------	---------------------

Mandatory			
T-MACH-107759	<a href="#">Master's Thesis</a>	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 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 or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITG or habilitated members 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 four 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 75 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. You need to have earned at least 75 credits in the following fields:
  - Internship
  - Interdisciplinary Supplement
  - Materials Science Major Course
  - Focal Course I
  - Focal Course II
  - Interdisciplinary Qualifications

**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 § 14 (3) SPO.

**Workload**

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

## M

**5.7 Module: Materials Characterization [M-MACH-103714]**

**Coordinators:** Prof. Dr. Astrid Pundt  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [Materials Science Major Course](#)

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

**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-107684	<a href="#">Materials Characterization</a>	4 CP	Gibmeier, Schneider
T-MACH-107685	<a href="#">Exercises for Materials Characterization</a>	2 CP	Gibmeier, Schneider
T-MACH-110946	<a href="#">Materials Characterization</a>	4 CP	Gibmeier, Schneider
T-MACH-110945	<a href="#">Exercises for Materials Characterization</a>	2 CP	Gibmeier, Schneider

**Assessment**

The assessment consists of a certificate and an oral exam (about 25 minutes).

**Prerequisites**

none

**Competence Goal**

The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.

**Content**

The following methods will be introduced within this module:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

**Workload**

The workload for the module "Materials Characterization" is 180 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 (99 h) and for the tutorials (48 h).

**Teaching and Learning Methods**

Lectures (Obligatory)

Tutorials (Obligatory)

**Literature**

Lecture notes (will be provided at the beginning of the lecture).

Literature will be announced at the beginning of the lecture.

## M

**5.8 Module: Materials Processing [M-MACH-103740]**

**Coordinators:** Prof. Dr.-Ing. Volker Schulze  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Focal Course I  
 Focal Course II

Credits	Grading	Recurrence	Duration	Language	Level	Version
16 CP	graded	Each term	2 terms	German	4	10

<b>Compulsary Elective Studies "X" (Election: at least 8 credits)</b>			
T-MACH-113985	Additive Manufacturing of Metallic Components	4 CP	Zanger
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CP	Ulrich
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CP	Schell
T-MACH-114100	Introduction to Microsystem Technology I	4 CP	Badilita, Korvink
T-MACH-114101	Introduction to Microsystem Technology II	4 CP	Badilita, Korvink
T-MACH-112763	Laser Material Processing	4 CP	Schneider
T-ETIT-100643	Laser Metrology	3 CP	Eichhorn
T-MACH-114439	Lightweight Design Workshop: Simulation and Manufacturing	4 CP	Kärger, Liebig
T-MACH-105782	Micro Magnetic Resonance	4 CP	Korvink, MacKinnon
T-ETIT-113941	Optical Engineering and Machine Vision	6 CP	Heizmann
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-105971	Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures	4 CP	Kärger
T-MACH-110937	Materials Recycling and Sustainability	4 CP	Liebig
<b>Compulsary Elective Studies PL without "X" (Election: )</b>			
T-CIWVT-110902	Additive Manufacturing for Process Engineering - Examination	5 CP	Klahn
T-MACH-105157	Foundry Technology	4 CP	Günther, Klan
T-CIWVT-108146	Materials and Processes for Electrochemical Storage	4 CP	Tübke
T-CIWVT-110903	Practical in Additive Manufacturing for Process Engineering	1 CP	Klahn
T-MACH-108878	Laboratory Production Metrology	4 CP	Benfer, Lanza
T-MACH-105170	Welding Technology	4 CP	Farajian
T-MACH-105177	Metal Forming	4 CP	Herlan
<b>Compulsary Elective Studies SL without "X" (Election: at most 4 credits)</b>			
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups	4 CP	Dietrich

**Assessment**

The success controls usually include four 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**

The students...

- can analyze novel situations, can select manufacturing processes in a goal-oriented manner and correlated to the materials used and are able to motivate their decision.
- are capable to describe theoretically and compare process-related changes in the materials properties.
- are enabled to generate novel solutions for given problems in the field of materials processing in due consideration of scientific principles, theories and methods.
- are capable to solve problems within the field of material processing in a team-oriented manner and can act responsibly and adequately
- are able to integrate the results of others when solving given problems.
- are enabled to identify, analyze, advance systems and processes considering technical, economic and social constraints.

**Content**

See the different courses of the module.

**Workload**

The usual work load is:

presence time: 90 h

preparation and rework time: 390 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

**5.9 Module: Properties [M-MACH-103713]**

**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
6 CP	graded	Each 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.

<b>Compulsory Elective Subjects (Election: 2 items as well as 6 credits)</b>			
T-MACH-107683	<a href="#">Exercises for Microstructure-Property-Relationships</a>	2 CP	Gruber, Kirchlechner
T-MACH-107604	<a href="#">Microstructure-Property-Relationships</a>	4 CP	Gruber, Kirchlechner
T-MACH-110930	<a href="#">Exercises for Microstructure-Property-Relationships</a>	2 CP	Gruber, Kirchlechner
T-MACH-110931	<a href="#">Microstructure-Property-Relationships</a>	4 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 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**

Lectures (Obligatory)  
Tutorials (Obligatory)

## M

**5.10 Module: Simulation [M-MACH-103712]**

**Coordinators:** Prof. Dr. Peter Gumbsch  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [Materials Science Major Course](#)

<b>Credits</b> 6 CP	<b>Grading</b> graded	<b>Recurrence</b> Each summer term	<b>Duration</b> 1 term	<b>Language</b> German/English	<b>Level</b> 4	<b>Version</b> 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.

<b>Compulsory Elective Subjects (Election: 2 items as well as 6 credits)</b>			
T-MACH-107671	<a href="#">Exercises for Applied Materials Simulation</a>	2 CP	Gumbsch, Schneider, Weygand
T-MACH-105527	<a href="#">Applied Materials Simulation</a>	4 CP	Gumbsch, Schneider, Weygand
T-MACH-110928	<a href="#">Exercises for Applied Materials Simulation</a>	2 CP	Gumbsch, Schneider, Weygand
T-MACH-110929	<a href="#">Applied Materials Simulation</a>	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 numerical 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

## M

## 5.11 Module: Structural Materials [M-MACH-103738]

**Coordinators:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Focal Course I  
 Focal Course II

**Credits**  
16 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
17

<b>Compulsory Elective Subjects "X" (Election: at least 8 credits)</b>			
T-MACH-114753	Advanced Ceramic Processing	4 CP	Pagnan Furlan
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-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-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-102157	High Performance Powder Metallurgy Materials	4 CP	Schell
T-MACH-105724	Failure Analysis (in German)	4 CP	Greiner, Schneider
T-MACH-112106	Fatigue of Materials	4 CP	Guth
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-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-114968	Non-destructive Materials Testing	6 CP	Dietrich
<b>Compulsory Elective Subjects PL without "X" (Election: )</b>			
T-MACH-105310	Design of Highly Stressed Components	4 CP	Aktaa
T-MACH-105516	Multi-Scale Plasticity	4 CP	Greiner, Schulz
<b>Compulsory Elective Subjects SL without "X" (Election: between 0 and 4 credits)</b>			
T-MACH-105651	Biomechanics: Design in Nature and Inspired by Nature	4 CP	Mattheck
T-MACH-112159	Hydrogen in Materials – Exercises and Lab Course	4 CP	Wagner
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 four 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: 90 h

preparation and rework time: 390 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: 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](#) (Usage from 10/1/2024)

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

## 5.13 Module: Technical Specialisation [M-MACH-103715]

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

**Credits**  
12 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
11

Compulsory Elective Subjects (Election: )			
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-MACH-102203	Automotive Engineering I	8 CP	Gauterin, Gießler
T-MACH-106424	Rail System Technology	4 CP	Cichon
T-CHEMBIO-105199	Basic Molecular Cell Biology	2 CP	Weth
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-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-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-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-MACH-103622	Measurement and Control Systems	6 CP	Stiller
T-MACH-111578	Sustainable Vehicle Drivetrains	4 CP	Toedter
T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle	4 CP	Dagan
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CP	Worgull
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CP	Worgull

T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CP	Worgull
T-MACH-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-108014	Robotics I - Introduction to Robotics	6 CP	Asfour
T-MACH-105353	Rail Vehicle Technology	4 CP	Cichon
T-MACH-106493	Solar Thermal Energy Systems	4 CP	Dagan
T-MACH-105290	Vibration Theory	4 CP	Fidlin
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-105366	Turbo Jet Engines	4 CP	Bauer
T-MACH-114854	Exercices - Tribology	2 CP	Dienwiebel
T-MACH-102170	Structural and Phase Analysis	4 CP	Wagner
T-MACH-102194	Combustion Engines I	4 CP	Koch, Kubach
T-MACH-104609	Combustion Engines II	4 CP	Koch, Kubach
T-MACH-105234	Windpower	4 CP	Lewald

**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**

The module Technical Specialisation serves the in-depth, also interdisciplinary examination of a topic of engineering sciences chosen according to one's own inclination. The students are able to explain and apply the basics of an individually chosen field of engineering science. The concrete learning objectives are given in the descriptions of the chosen courses.

**Content**

see title and content of the given courses.

**Workload**

The work load is generally:

presence time: 68 h

preparation and rework tim: 292 h

However, the composition of the work load can vary according to the individually choice.

**Teaching and Learning Methods**

lectures

## M

**5.14 Module: Thermodynamics [M-MACH-103710]****Coordinators:** Prof. Dr. Hans Jürgen Seifert**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Materials Science Major Course](#)

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

**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

<b>Compulsory Elective Subjects (Election: 2 items as well as 6 credits)</b>			
T-MACH-107669	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	2 CP	Seifert
T-MACH-107670	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	4 CP	Franke, Seifert
T-MACH-110924	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	2 CP	Seifert
T-MACH-110925	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	4 CP	Seifert

**Assessment**

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

**Prerequisites**

none

**Competence Goal**

The students know about the constitution (heterogeneous equilibria, phase diagrams) of binary, ternary and multi-component materials systems. They are able to analyze the thermodynamic properties of single and multiphase materials and their reactions with gas and liquid phases, respectively. They can apply the learned relationships to questions of production, joining, and applications of engineering materials (metallic alloy, technical ceramics, composites).

**Content**

1. Binary phase diagrams
2. Ternary phase diagrams
  - Complete solubility
  - Eutectic systems
  - Peritectic systems
  - Systems with transition reactions
  - Systems with intermetallic phases
3. Thermodynamics of solution phases
4. Materials reactions involving pure condensed phases and a gaseous phase
5. Reaction equilibria in systems containing components in condensed solutions
6. Thermodynamics of multicomponent multiphase materials systems
7. Calculation of Phase Diagrams (CALPHAD)

**Module Grade Calculation**

- The module grade is equal to the grade of the oral exam

**Additional Information**

The participation in Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria is obligatory.

**Workload**

The workload for the module "Thermodynamics" is 180 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 (99 h) and for the tutorials (48 h).

**Recommendations**

- Basic course in materials science and engineering
- Basic Course in mathematics
- physics or physical chemistry

Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (P. Franke).

**Teaching and Learning Methods**

Lectures (Obligatory)  
Tutorials (Obligatory)

**Literature**

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)
2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

## 6 Module components

### T


### 6.1 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2313724	<a href="#">Adaptive Optics</a>	2 SWS	Lecture / 	Gladysz
Exams					
WT 25/26	7313724	<a href="#">Adaptive Optics</a>			Lemmer, Gladysz
ST 2026	7313724	<a href="#">Adaptive Optics</a>			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****6.2 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-103740 - Materials Processing](#)

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

Courses					
ST 2026	2241020	<a href="#">Additive Manufacturing for Process Engineering</a>	2 SWS	Lecture / 	Klahn
Exams					
WT 25/26	7241020	<a href="#">Additive Manufacturing for Process Engineering - Examination</a>			Klahn
ST 2026	7241020	<a href="#">Additive Manufacturing for Process Engineering - Examination</a>			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

**6.3 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2149671	<a href="#">Additive Manufacturing of Metallic Components</a>	2 SWS	Lecture / 	Zanger
Exams					
WT 25/26	76-T-MACH-113985	<a href="#">Additive Manufacturing of Metallic Components</a>			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**2149671, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)  
On-Site**

**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

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

**Coordinators:** Prof. Dr. Kaline Pagnan Furlan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2126730	<a href="#">Advanced ceramics processing (EN)</a>	2 SWS	Lecture / 	Pagnan Furlan
Exams					
WT 25/26	76-T-MACH-114753	<a href="#">Advanced Ceramic Processing</a>			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**

- (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](https://katalog.bibliothek.kit.edu/cgi-bin/koha/opac-detail.pl?biblionumber=309052&query_desc=callister)
- 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> \*
- 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.

## T


**6.5 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	Grading graded	Each summer term	1

Courses					
ST 2026	2182616	<a href="#">Applied Materials Simulation</a>	4 SWS	Lecture / Practice / 	Gumbsch, Weygand
Exams					
WT 25/26	76-T-MACH-110929	<a href="#">Applied Materials Simulation</a>			Gumbsch, Schulz
ST 2026	76-T-MACH-110929	<a href="#">Applied Materials Simulation</a>			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 knowledge 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

**6.6 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	<a href="#">Applied Materials Simulation</a>	4 SWS	Lecture / Practice /	Gumbsch, Weygand
Exams					
WT 25/26	76-T-MACH-105527	<a href="#">Applied Materials Modelling</a>			Gumbsch, Schulz
ST 2026	76-T-MACH-105527	<a href="#">Applied Materials Modelling</a>			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 knowledge 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 wird 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

**6.7 Module component: Applied Surface Materials [T-MACH-114646]**

**Coordinators:** Prof. Dr. Anass Benayad  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2181550	<a href="#">Applied Surface Materials</a>	2 SWS	Lecture /	Benayad
Exams					
WT 25/26	76-T-MACH-114646	<a href="#">Applied Surface Materials</a>			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

**T****6.8 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-103715 - Technical Specialisation](#)

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


**6.9 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2113809	<a href="#">Automotive Engineering I</a>	4 SWS	Lecture / 	Gießler
Exams					
WT 25/26	76-T-MACH-102203	<a href="#">Automotive Engineering I</a>			Gießler
ST 2026	76-T-MACH-102203	<a href="#">Automotive Engineering I</a>			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](mailto: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, Chichester 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.: Skriptum zur Vorlesung 'Automotive Engineering I', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

## T

**6.10 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-103715 - Technical Specialisation](#)

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

Courses						
WT 25/26	2113805	<a href="#">Automotive Engineering I</a>	4 SWS	Lecture /	Gießler	
Exams						
WT 25/26	76-T-MACH-100092	<a href="#">Automotive Engineering</a>				Gießler
ST 2026	76-T-MACH-100092	<a href="#">Automotive Engineering</a>				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.

**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/Passwoerterllias/>*

Kann nicht mit der Veranstaltung [2113809] kombiniert werden.

Can not be combined with lecture [2113809].

**Literature**

1. Mitschke, M. / Wallentowitz, H.: Dynamik der Kraftfahrzeuge, Springer Vieweg, Wiesbaden 2014
2. Pischinger, S. / Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Springer Vieweg, Wiesbaden 2016
3. Gauterin, F. / Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung "Grundlagen der Fahrzeugtechnik I", KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

T

**6.11 Module component: Basic Molecular Cell Biology [T-CHEMBIO-105199]**

**Coordinators:** Dr. Franco Weth  
**Organisation:** KIT Department of Chemistry and Biosciences  
**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Exams			
WT 25/26	71KSOP-105199	<a href="#">Basic Molecular Cell Biology</a>	Weth

**Assessment**

The written exam over 120 Minutes is scheduled for the beginning of the break after the SS.  
 A resit exam is offered at the end of the break.

**Prerequisites**

none

**Recommendations**

Basic knowledge in General Chemistry

**Workload**

60 hours

T

**6.12 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

## 6.13 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	5072	<a href="#">Batteries and Fuel Cells</a>	2 SWS	Lecture / 	Ehrenberg, Scheiba
Exams					
WT 25/26	7100050	<a href="#">Batteries and Fuel Cells</a>	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



## 6.14 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2304240	<a href="#">Batteries, Fuel Cells and Electrolysis</a>	2 SWS	Lecture / 	Krewer
WT 25/26	2304241	<a href="#">Practical Exercise to 2304240 Batteries, Fuel Cells and Electrolysis</a>	2 SWS	Practice / 	Krewer, Sonder
Exams					
WT 25/26	7304240	<a href="#">Batteries, Fuel Cells, and Electrolysis</a>			Krewer
ST 2026	7304240	<a href="#">Batteries, Fuel Cells, and Electrolysis</a>			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

## 6.15 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-103741 - Functional Materials](#)

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

**6.16 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2186100	<a href="#">Beyond Conventional Materials - Metamaterials &amp; Architected Structures</a>	2 SWS	Lecture / 	Bauer
Exams					
WT 25/26	76-T-MACH-113698	<a href="#">Beyond Conventional Materials - Metamaterials &amp; Architected Structures</a>			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-architected 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 14:14, 1–17 (2023).

T

**6.17 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2181708	<a href="#">Biomechanics: Design in Nature and Inspired by Nature</a>	3 SWS	/ 	Mattheck
Exams					
WT 25/26	76-T-MACH-105651	<a href="#">Biomechanics: design in nature and inspired by nature</a>			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


## 6.18 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2141864	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 25/26	76-T-MACH-100966	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>			Guber
ST 2026	76-T-MACH-100966	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>			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

## 6.19 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-103715 - Technical Specialisation](#)


**Type**  
Written examination





**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
3

Courses					
ST 2026	2142883	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 25/26	76-T-MACH-100967	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>			Guber
ST 2026	76-T-MACH-100967	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>			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 Crystallisation

Microarrays

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

**6.20 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2142879	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 25/26	76-T-MACH-100968	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>			Guber
ST 2026	76-T-MACH-100968	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>			Guber

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

Written exam (75 Min.)

**Prerequisites**

none

**Additional Information**

The course is offered in German

**Workload**

120 hours

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

## V

**BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III**2142879, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)  
On-Site****Content**

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

**Organizational issues**

Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.  
 schriftl. Prüfung: Mo, 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





**6.21 Module component: CAE-Workshop [T-MACH-105212]**

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

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2147175	<a href="#">CAE-Workshop</a>	3 SWS	Block / 	Düser
ST 2026	2147175	<a href="#">CAE-Workshop</a>	3 SWS	Block / 	Düser
Exams					
WT 25/26	76-T-MACH-105212	<a href="#">CAE-Workshop</a>			Düser
ST 2026	76-T-MACH-105212	<a href="#">CAE-Workshop</a>			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)
- Stress and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the 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)
- Stress and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the 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


## 6.22 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2133113	<a href="#">CO2-neutral combustion engines and their fuels I</a>	3 SWS	Lecture / Practice / 	Koch
Exams					
WT 25/26	76-T-MACH-102194	<a href="#">CO2-neutral combustion engines and their fuels I</a>			Kubach, Koch
ST 2026	76-T-MACH-102194	<a href="#">CO2-neutral combustion engines and their fuels I</a>			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


**6.23 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2134151	<a href="#">CO2-neutral combustion engines and their fuels II</a>	3 SWS	Lecture / Practice / 	Koch
Exams					
WT 25/26	76-T-MACH-104609	<a href="#">Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II</a>	Kubach, Koch		
ST 2026	76-T-MACH-104609	<a href="#">Combustion Engines, Hydrogen Engines and CO2 neutral Fuels II</a>	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


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




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

Lightweight Design

**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2114053	<a href="#">Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</a>	2 SWS	Lecture / 	Henning
Exams					
WT 25/26	76-T-MACH-105535	<a href="#">Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</a>			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**

2114053, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**Physical connections of fiber reinforcementUse 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 - textilesProcess technologies - prepregsRecycling 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



## 6.25 Module component: Computational Condensed Matter Physics [T-PHYS-109895]





**Coordinators:** Prof. Dr. Wolfgang Wenzel

**Organisation:** KIT Department of Physics

**Part of:** [M-MACH-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	4023161	<a href="#">Computational Condensed Matter Physics</a>	4 SWS	Lecture / 	Wenzel
ST 2026	4023162	<a href="#">Exercises to Computational Condensed Matter Physics</a>	2 SWS	Practice / 	Wenzel

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

## T

**6.26 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2161250	<a href="#">Computational Elasticity</a>	2 SWS	Lecture /	Langhoff, Böhlke
Exams					
WT 25/26	76-T-MACH-113989	<a href="#">Computational Elasticity</a>			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


**6.27 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162296	<a href="#">Computational Inelasticity</a>	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 plasticity; linear and geometrically 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

**6.28 Module component: Computational Photonics, without ext. Exercises [T-PHYS-106131]****Coordinators:** Prof. Dr. Carsten Rockstuhl**Organisation:** KIT Department of Physics**Part of:** [M-MACH-103739 - Computational Materials Science](#)**Type**  
Oral examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
2

<b>Courses</b>					
WT 25/26	4023021	<a href="#">Computational Photonics</a>	2 SWS	Lecture	Rockstuhl
WT 25/26	4023022	<a href="#">Übungen zu Computational Photonics</a>	2 SWS	Practice	Rockstuhl, Nyman
<b>Exams</b>					
WT 25/26	7800095	<a href="#">Computational Photonics, without ext. Exercises</a>			Rockstuhl

T


## 6.29 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2177601	<a href="#">Constitution and Properties of Protective Coatings</a>	2 SWS	Lecture / 	Ulrich
Exams					
WT 25/26	76-T-MACH-105150	<a href="#">Constitution and Properties of Protective Coatings</a>			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](mailto: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


**6.30 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2106014	<a href="#">Data Analytics for Engineers</a>	3 SWS	Lecture / Practice / 	Mikut, Reischl
Exams					
WT 25/26	76-T-MACH-105694	<a href="#">Data Analytics for Engineers</a>			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

**6.31 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-103739 - Computational Materials Science](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

Courses					
ST 2026	2182741	<a href="#">Data Science and Scientific Workflows</a>	3 SWS	Lecture / Practice / X	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****6.32 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2182741	<a href="#">Data Science and Scientific Workflows</a>	3 SWS	Lecture / Practice / X	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


## 6.33 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-103738 - Structural Materials](#)  
[M-MACH-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2181745	<a href="#">Design of highly stressed components</a>	2 SWS	Lecture / 	Aktaa
Exams					
WT 25/26	76-T-MACH-105310	<a href="#">Design of Highly Stressed Components</a>			Aktaa
ST 2026	76-T-MACH-105310	<a href="#">Design of Highly Stresses Components</a>			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 understand 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 Science, 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


## 6.34 Module component: Drive System Engineering A: Automotive Systems [T-MACH-113405]





**Coordinators:** Sascha Ott

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2146231	<a href="#">Drive System Engineering A: Automotive Systems</a>	3 SWS	Lecture / Practice / 	Ott, Düser
Exams					
WT 25/26	76-T-MACH-113405	<a href="#">Drive System Engineering A: Automotive Systems</a>			Ott
ST 2026	76-T-MACH-113405	<a href="#">Drive System Engineering A: Automotive Systems</a>			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

## 6.35 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

**6.36 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

**6.37 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



## 6.38 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2141110	<a href="#">Electromagnetics and Numerical Calculation of Fields</a>	2 SWS	Lecture / 	Deng
WT 25/26	2141111	<a href="#">Exercise for 2308263 Electromagnetics and Numerical Calculation of Fields</a>	1 SWS	Practice / 	Deng
Exams					
WT 25/26	7308263	<a href="#">Electromagnetics and Numerical Calculation of Fields</a>			Deng
ST 2026	7600003	<a href="#">Electromagnetics and Numerical Calculation of Fields</a>			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

**6.39 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-103715 - Technical Specialisation](#)**Type**  
Oral examination**Credits**  
16 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

<b>Courses</b>					
WT 25/26	4027011	<a href="#">Electron Microscopy I</a>	2 SWS	Lecture / 	Eggeler, Hettler
WT 25/26	4027012	<a href="#">Exercises to Electron Microscopy I</a>	2 SWS	Practice / 	Eggeler, Hettler
ST 2026	4027021	<a href="#">Electron Microscopy II</a>	2 SWS	Lecture / 	Eggeler, Hettler, Hettler, Müller
ST 2026	4027022	<a href="#">Exercises to Electron Microscopy II</a>	2 SWS	Practice / 	Eggeler

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

Oral Exam, approx. 60 minutes.

**Prerequisites**

none


**T****6.40 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	4021011	<a href="#">Electronic Properties of Solids I</a>	4 SWS	Lecture / 	Le Tacon, Wernsdorfer

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

**Prerequisites**

none

T


## 6.41 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	4021111	<a href="#">Electronic Properties of Solids II</a>	2 SWS	Lecture / 	Ustinov

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

### Prerequisites

none

T

## 6.42 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-103738 - Structural Materials](#)

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


## 6.43 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-103738 - Structural Materials](#)

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

Courses					
ST 2026	2182100	<a href="#">Energy Efficient and Sustainable Tribological Systems</a>	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

**6.44 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2117500	<a href="#">Energy efficient intralogistic systems</a>	2 SWS	Lecture /	Kramer, Schönung
Exams					
WT 25/26	76-T-MACH-105151	<a href="#">Energy Efficient Intralogistic Systems</a>			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 known.

**Literature**

Keine.

## T

**6.45 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2193008	<a href="#">Engineering Materials for the Energy Transition</a>	2 SWS	Lecture / 🎧	Seifert, Ziebert
Exams					
WT 25/26	76-T-MACH-112691	<a href="#">Engineering Materials for the Energy Transition</a>			Seifert
ST 2026	76-T-MACH-112691	<a href="#">Engineering Materials for the Energy Transition</a>			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


## 6.46 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2193007	<a href="#">Engineering Materials for the Energy Transition</a>	2 SWS	Lecture / 	Seifert, Ziebert
Exams					
WT 25/26	76-T-MACH-109082	<a href="#">Engineering Materials for the Energy Transition</a>			Seifert
ST 2026	76-T-MACH-109082	<a href="#">Engineering Materials for the Energy Transition</a>			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


## 6.47 Module component: Exercises - Tribology [T-MACH-114854]

**Coordinators:** Prof. Dr. Martin Dienwiebel

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2181114	<a href="#">Tribology</a>	5 SWS	Lecture / Practice / 	Dienwiebel, Scherge
Exams					
WT 25/26	76-T-MACH-114854	<a href="#">Exercices - Tribology (new, MACH, PO 2025)</a>			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, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear  
plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication  
base oils, 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


## 6.48 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	<a href="#">Applied Materials Simulation</a>	4 SWS	Lecture / Practice / 	Gumbsch, Weygand
Exams					
ST 2026	76-T-MACH-110928	<a href="#">Exercises for Applied Materials Simulation</a>			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 knowledge 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

## 6.49 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	<a href="#">Applied Materials Simulation</a>	4 SWS	Lecture / Practice /	Gumbsch, Weygand
Exams					
ST 2026	76-T-MACH-107671	<a href="#">Exercises for Applied Materials Simulation</a>			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 knowledge 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 wird 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

**6.50 Module component: Exercises for Fundamentals in Materials  
Thermodynamics and Heterogeneous Equilibria [T-MACH-107669]****Coordinators:** Prof. Dr. Hans Jürgen Seifert**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103710 - Thermodynamics](#)

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

Courses					
WT 25/26	2193005	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	1 SWS	Practice / 	Seifert, Ziebert, Dürschnabel
Exams					
WT 25/26	76-T-MACH-107669	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert

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

successful solving of all exercises

**Prerequisites**

T-MACH-110924 – Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-110924 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) 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

**Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria**2193005, WS 25/26, 1 SWS, Language: German, [Open in study portal](#)Practice (Ü)  
On-Site

**Content**

1. Ternary phase diagrams
  - Complete solubility
  - Eutectic systems
2. Thermodynamics of solution phases
3. Materials reactions involving pure condensed phases and a gaseous phase
4. Reaction equilibria in systems containing components in condensed solutions

This exercise deals with the construction of isothermal sections and isopleths in ternary materials systems. The thermodynamic properties of multiphase engineering materials are calculated.

Recommendations:

- Lecture in Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria
- Basic course in materials science and engineering
- physical chemistry

regular attendance: 14 hours

self-study: 46 hours

**Organizational issues**

Die genauen Termine werden in der ersten Vorlesung (29.10.25) bekannt gegeben.

Die Übungen finden ab der zweiten Vorlesungswoche montags, 09:45-11:15 Uhr in Geb. 10.50, HS 102 statt.


**Literature**





1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)
2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

T

**6.51 Module component: Exercises for Fundamentals in Materials  
Thermodynamics and Heterogeneous Equilibria [T-MACH-110924]****Coordinators:** Prof. Dr. Hans Jürgen Seifert**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103710 - Thermodynamics](#)

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

Courses					
ST 2026	2194721	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	1 SWS	Practice / 	Seifert, Dürrschnabel
Exams					
WT 25/26	76-T-MACH-110924	<a href="#">Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert

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

successful solving of all exercises

**Prerequisites**

T-MACH-107669 Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte has not been started

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-107669 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) 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 for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria**2194721, SS 2026, 1 SWS, Language: English, [Open in study portal](#)Practice (Ü)  
On-Site

**Content**

1. Ternary phase diagrams
  - Complete solubility
  - Eutectic systems
2. Thermodynamics of solution phases
3. Materials reactions involving pure condensed phases and a gaseous phase
4. Reaction equilibria in systems containing components in condensed solutions

This exercise deals with the construction of isothermal sections and isopleths in ternary materials systems. The thermodynamic properties of multiphase engineering materials are calculated.

Recommendations:

- Lecture in Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria
- Basic course in materials science and engineering
- physical chemistry

regular attendance: 14 hours

self-study: 46 hours

**Literature**

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)
2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

T

## 6.52 Module component: Exercises for Materials Characterization [T-MACH-107685]

**Coordinators:** Dr.-Ing. Jens Gibmeier  
Prof. Dr. Reinhard Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103714 - Materials Characterization](#)

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

### Assessment

Regular attendance

### Prerequisites

T-MACH-110945 – Exercises for Materials Characterization has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-110945 - Exercises for Materials Characterization](#) must not have been started.

### Additional Information

The course is offered in German.

### Workload

60 hours

## T

## 6.53 Module component: Exercises for Materials Characterization [T-MACH-110945]

**Coordinators:** Dr.-Ing. Jens Gibmeier  
Prof. Dr. Reinhard Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103714 - Materials Characterization](#)

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

Courses					
WT 25/26	2173432	<a href="#">Tutorials and Lab Courses for "Materials Characterization"</a>	1 SWS	Practice /	Gibmeier, Peterlechner
ST 2026	2173432	<a href="#">Tutorials and Lab Courses for "Materials Characterization"</a>	1 SWS	Practice /	Gibmeier, Peterlechner
Exams					
WT 25/26	76-T-MACH-110945	<a href="#">Exercises for Materials Characterization</a>			Gibmeier
ST 2026	76-T-MACH-110945	<a href="#">Exercises for Materials Characterization</a>			Gibmeier

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

### Assessment

Regular attendance

### Prerequisites

T-MACH-107685 – Übungen zu Werkstoffanalytik has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107685 - Exercises for Materials Characterization](#) must not have been started.

### Additional Information

The course is offered in English.

### Workload

60 hours

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



### Tutorials and Lab Courses for "Materials Characterization"

2173432, WS 25/26, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)  
On-Site

### Content

s. lecture "materials characterization" (V-No. 2174586)

### Literature

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.



### Tutorials and Lab Courses for "Materials Characterization"

2173432, SS 2026, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)  
On-Site

### Content

s. lecture "materials characterization" (V-No. 2174586)

### Literature

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T

## 6.54 Module component: Exercises for Microstructure-Property-Relationships [T-MACH-110930]

**Coordinators:** Dr. Patric Gruber  
Prof. Dr. Christoph Kirchlechner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103713 - Properties](#)

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

Courses					
WT 25/26	2177021	<a href="#">Exercises in Microstructure-Property-Relationships</a>	1 SWS	Practice /	Kirchlechner, Wagner, Gruber
Exams					
WT 25/26	76-T-MACH-110930	<a href="#">Exercises for Microstructure-Property-Relationships</a>			Kirchlechner, Gruber, Wagner

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

### Assessment

Successful participation in a final colloquium

### Prerequisites

T-MACH-107683 – Übungen zu Gefüge-Eigenschafts-Beziehungen has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107683 - Exercises for Microstructure-Property-Relationships](#) 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


## 6.55 Module component: Exercises for Microstructure-Property-Relationships [T-MACH-107683]

**Coordinators:** Dr. Patric Gruber  
Prof. Dr. Christoph Kirchlechner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103713 - Properties](#)

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

Courses					
ST 2026	2178125	<a href="#">Exercices in Microstructure-Property-Relationships</a>	1 SWS	Practice / 	Kirchlechner, Wagner, Gruber
Exams					
ST 2026	76-T-MACH-107683	<a href="#">Exercices for Microstructure-Property-Relationships</a>			Kirchlechner, Gruber, Wagner

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

### Assessment

Successful participation in a final colloquium

### Prerequisites

T-MACH-110930 – Exercises for Microstructure-Properties-Relationships has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-110930 - 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


## 6.56 Module component: Exercises for Solid State Reactions and Kinetics of Phase Transformations [T-MACH-107632]





**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr  
Dr. Christopher Stihl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103711 - Kinetics](#)

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

Courses					
WT 25/26	2193004	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations</a>	1 SWS	Practice / 	Gorr, Stihl
Exams					
WT 25/26	76-T-MACH-107632	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations</a>			Gorr, Stihl

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

### Assessment

successful processing of exercises

### Prerequisites

T-MACH-110926 – Exercises for Solid State Reactions and Kinetics of Phase Transformations has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-110926 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) 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

## Exercises for Solid State Reactions and Kinetics of Phase Transformations

2193004, WS 25/26, 1 SWS, Language: German, [Open in study portal](#)

Practice (Ü)  
On-Site

### Content

1. Fick's laws of diffusion
2. Calculation of diffusion coefficients
3. Diffusion and solidification

Recommendations: Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry

Reinforcement of the lecture by the solution of practical and lecture-relevant exercises

regular attendance: 14 hours

self-study: 46 hours

### Literature

Vorlesungsskript;

Lecture notes

T


## 6.57 Module component: Exercises for Solid State Reactions and Kinetics of Phase Transformations [T-MACH-110926]





**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103711 - Kinetics](#)

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

Courses					
ST 2026	2194723	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations, Corrosion</a>	1 SWS	Practice / 	Gorr
Exams					
WT 25/26	76-T-MACH-110926	<a href="#">Exercises for Solid State Reactions and Kinetics of Phase Transformations</a>			Gorr

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

### Assessment

successful processing of exercises

### Prerequisites

T-MACH-107632 – Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion has not been started

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) must 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 for Solid State Reactions and Kinetics of Phase Transformations, Corrosion

2194723, SS 2026, 1 SWS, Language: English, [Open in study portal](#)

Practice (Ü)  
On-Site

### Content

1. Fick's laws of diffusion
2. Calculation of diffusion coefficients
3. Diffusion and solidification

Recommendations: Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry

Reinforcement of the lecture by the solution of practical and lecture-relevant exercises

the first exercise will take place on 27.06.2024 at 11:30 - 13:00 in building 10.50 in room 602. From then on, the exercise will take place weekly and will end with a test on 22.07.2024. In order to be admitted for the oral exam, this test must be passed. Therefore, please register for the test online in the system by 17.07.2024.

regular attendance: 14 hours

self-study: 46 hours

### Literature

Vorlesungsskript;

Lecture notes

T

## 6.58 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2173560	<a href="#">Welding Lab Course, in groupes</a>	3 SWS	Practical course /	Dietrich, Schulze
Exams					
WT 25/26	76-T-MACH-102099	<a href="#">Experimental Lab Class in Welding Technology, in Groups</a>			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](mailto: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****6.59 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-103715 - Technical Specialisation](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

<b>Courses</b>					
ST 2026	2313760	<a href="#">Fabrication and Characterization of Optoelectronic Devices</a>	2 SWS	Lecture / 	Paetzold
<b>Exams</b>					
WT 25/26	7313760	<a href="#">Fabrication and Characterisation of Optoelectronic Devices</a>			Paetzold
ST 2026	7313760	<a href="#">Fabrication and Characterisation of Optoelectronic Devices</a>			Paetzold

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

none

T


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





**Coordinators:** Dr. Klaus Bade

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2143882	<a href="#">Fabrication Processes in Microsystem Technology</a>	2 SWS	Lecture / 	Bade
Exams					
WT 25/26	76-T-MACH-102166	<a href="#">Fabrication Processes in Microsystem Technology</a>			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

**6.61 Module component: Failure Analysis [T-MACH-114610]**

**Coordinators:** Jun.-Prof. Dr. Jens Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2182102	<a href="#">Failure Analysis</a>	2 SWS	Lecture / 🎧	Bauer

Legend: 📺 Online, 🔄 Blended (On-Site/Online), 🎧 On-Site, ✕ 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


**6.62 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2182572	<a href="#">Failure Analysis</a>	2 SWS	Lecture / 	Greiner, Schneider
Exams					
WT 25/26	76-T-MACH-105724	<a href="#">Failure Analysis</a>			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

**6.63 Module component: Fatigue of Materials [T-MACH-112106]****Coordinators:** Dr.-Ing. Stefan Guth**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2173586	<a href="#">Fatigue of Materials</a>	2 SWS	Lecture / 	Guth
Exams					
WT 25/26	76-T-MACH-112106	<a href="#">Fatigue of Materials</a>			Guth
ST 2026	76-T-MACH-112106	<a href="#">Fatigue of Materials</a>			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 enthält, wird in der Vorlesung verteilt.

T


## 6.64 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2181720	<a href="#">Foundations of nonlinear continuum mechanics</a>	2 SWS	Lecture / 	Kamlah
Exams					
WT 25/26	76-T-MACH-105324	<a href="#">Foundations of Nonlinear Continuum Mechanics</a>			Kamlah
ST 2026	76-T-MACH-105324	<a href="#">Foundations of Nonlinear Continuum Mechanics</a>			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 third 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

**6.65 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-103740 - Materials Processing](#)

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

Courses					
ST 2026	2174575	<a href="#">Foundry Technology</a>	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

## 6.66 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	6215903	<a href="#">Fracture and Damage Mechanics</a>	2 SWS	Lecture / 	Seelig
WT 25/26	6215904	<a href="#">Exercises Fracture and Damage Mechanics</a>	2 SWS	Practice / 	Seelig
Exams					
WT 25/26	8243100087	<a href="#">Fracture and Damage Mechanics</a>	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


## 6.67 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2133108	<a href="#">Fuels and Lubricants for Combustion Engines</a>	2 SWS	Lecture / 	Kehrwald
Exams					
WT 25/26	76-T-MACH-105184	<a href="#">Fuels and Lubricants for Combustion Engines</a>			Kehrwald
ST 2026	76-T-MACH-105184	<a href="#">Fuels and Lubricants for Combustion Engines</a>			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

**6.68 Module component: Functional Ceramics [T-MACH-105179]****Coordinators:** Dr. Miriam Botros**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2126784	<a href="#">Functional Ceramics</a>	2 SWS	Lecture / 	Botros
Exams					
WT 25/26	76-T-MACH-105179	<a href="#">Functional Ceramics</a>			Botros
ST 2026	76-T-MACH-105179	<a href="#">Functional Ceramics</a>			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

**6.69 Module component: Functional Ceramics [T-MACH-114752]**

**Coordinators:** Prof. Dr. Kaline Pagnan Furlan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2125740	<a href="#">Functional Ceramics (EN)</a>	2 SWS	Lecture / 	Pagnan Furlan
ST 2026	2125740	<a href="#">Functional Ceramics (EN)</a>	2 SWS	Lecture / 	Pagnan Furlan
Exams					
WT 25/26	76-T-MACH-114752	<a href="#">Functional Ceramics</a>	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


## 6.70 Module component: Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-110925]





**Coordinators:** Prof. Dr. Hans Jürgen Seifert

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103710 - Thermodynamics](#)

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

Courses					
ST 2026	2194720	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	2 SWS	Lecture / 	Seifert, Dürrschnabel
Exams					
WT 25/26	76-T-MACH-110925	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert
ST 2026	76-T-MACH-110925	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert

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

### Assessment

Oral examination (about 30 min)

### Prerequisites

The successful participation in Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria is the condition for the admittance to the oral exam in Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria.

T-MACH-107669 – Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte has not been started.

T-MACH-107670 – Thermodynamische Grundlagen / Heterogene Gleichgewichte has not been started.

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107670 - Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must not have been started.
2. The module component [T-MACH-110924 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must have been passed.
3. The module component [T-MACH-107669 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must not have been started.

### Recommendations

Basic course in materials science and engineering

Basic course in mathematics

physics or physical chemistry

### 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 in Materials Thermodynamics and Heterogeneous Equilibria

2194720, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Oral examination (about 30 min)

Teaching Content:

1. Binary phase diagrams
2. Ternary phase diagrams
  - Complete solubility
  - Eutectic systems
  - Peritectic systems
  - Systems with transition reactions
  - Systems with intermetallic phases
3. Thermodynamics of solution phases
4. Materials reactions involving pure condensed phases and a gaseous phase
5. Reaction equilibria in systems containing components in condensed solutions
6. Thermodynamics of multicomponent multiphase materials systems
7. Calculation of Phase Diagrams (CALPHAD)

**Recommendations:**

Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (Gorr); basic course in materials science and Engineering; basic course in mathematics; physics or physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students know the heterogeneous phase equilibria of binary, ternary and multicomponent materials systems. They can analyze the thermodynamic properties of multiphase engineering materials and their reactions with gas and liquid phases.

**Literature**

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)
2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

## T


**6.71 Module component: Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria [T-MACH-107670]**





**Coordinators:** Dr. Peter Franke  
Prof. Dr. Hans Jürgen Seifert

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103710 - Thermodynamics](#)

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

Courses					
WT 25/26	2193002	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>	2 SWS	Lecture / 	Seifert, Dürrschnabel
Exams					
WT 25/26	76-T-MACH-107670	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert
ST 2026	76-T-MACH-107670	<a href="#">Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria</a>			Seifert

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

**Assessment**

Oral examination (about 30 min)

**Prerequisites**

The successful participation in Übungen zu Thermodynamische Grundlagen / Heterogene Gleichgewichte is the condition for the admittance to the oral exam in Thermodynamische Grundlagen / Heterogene Gleichgewicht.

T-MACH-110924 – Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started.

T-MACH-110925 – Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria has not been started.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-107669 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must have been passed.
2. The module component [T-MACH-110925 - Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must not have been started.
3. The module component [T-MACH-110924 - Exercises for Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria](#) must not have been started.

**Recommendations**

Basic course in materials science and engineering

Basic course in mathematics

physics or physical chemistry

**Additional Information**

The course is offered in German.

**Workload**

120 hours

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

## V

**Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria**

2193002, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Oral examination (about 30 min)

Teaching Content:

1. Binary phase diagrams
2. Ternary phase diagrams
  - Complete solubility
  - Eutectic systems
  - Peritectic systems
  - Systems with transition reactions
  - Systems with intermetallic phases
3. Thermodynamics of solution phases
4. Materials reactions involving pure condensed phases and a gaseous phase
5. Reaction equilibria in systems containing components in condensed solutions
6. Thermodynamics of multicomponent multiphase materials systems
7. Calculation of Phase Diagrams (CALPHAD)

**Recommendations:**

Knowledge of the course "Solid State Reactions and Kinetics of Phase Transformations" (Franke); basic course in materials science and Engineering; basic course in mathematics; physics or physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students know the heterogeneous phase equilibria of binary, ternary and multicomponent materials systems. They can analyze the thermodynamic properties of multiphase engineering materials and their reactions with gas and liquid phases.

**Literature**

1. Phase Equilibria, Phase Diagrams and Phase Transformations, Their Thermodynamic Basis; M. Hillert, University Press, Cambridge (2007)
2. Introduction to the Thermodynamics of Materials; D.R. Gaskell, Taylor & Francis (2008)

T

## 6.72 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2113812	<a href="#">Fundamentals in the Development of Commercial Vehicles I</a>	1 SWS	Lecture / 	Weber
ST 2026	2114844	<a href="#">Fundamentals in the Development of Commercial Vehicles II</a>	1 SWS	Lecture / 	Weber
Exams					
WT 25/26	76-T-MACH-111389	<a href="#">Fundamentals in the Development of Commercial Vehicles</a>			Weber
ST 2026	76-T-MACH-111389	<a href="#">Fundamentals in the Development of Commercial Vehicles</a>			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

2113812, WS 25/26, 1 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

### 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/Passwoerterliias/>

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. Morscheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.



## 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.): Bremsanlagen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994
- 4.RUBI, V.; STRIFLER, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Industrielle 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

**6.73 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	3165016	<a href="#">Fundamentals of Combustion I</a>	2 SWS	Lecture / 🗣️	Shrotriya
WT 25/26	3165017	<a href="#">Fundamentals of Combustion I (Tutorial)</a>	1 SWS	Practice / 🗣️	Shrotriya
Exams					
WT 25/26	76-T-MACH-114043	<a href="#">Fundamentals of Combustion I</a>			Bykov
ST 2026	76-T-MACH-114043	<a href="#">Fundamentals of Combustion I</a>			Bykov

Legend: 🗣️ Online, 🗣️📖 Blended (On-Site/Online), 🗣️ On-Site, ✖ Canceled

**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
- NO<sub>x</sub> 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





## 6.74 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2165515	<a href="#">Fundamentals of Combustion I</a>	2 SWS	Lecture / 	Yu
WT 25/26	2165517	<a href="#">Fundamentals of Combustion I (Tutorial)</a>	1 SWS	Practice / 	Yu
WT 25/26	3165016	<a href="#">Fundamentals of Combustion I</a>	2 SWS	Lecture / 	Shrotriya
WT 25/26	3165017	<a href="#">Fundamentals of Combustion I (Tutorial)</a>	1 SWS	Practice / 	Shrotriya
Exams					
WT 25/26	76-T-MACH-105213	<a href="#">Fundamentals of Combustion I</a>			Bykov
WT 25/26	76-T-MACH-105213 - english	<a href="#">Fundamentals of Combustion I</a>			Bykov
ST 2026	76-T-MACH-105213	<a href="#">Fundamentals of Combustion I</a>			Bykov
ST 2026	76-T-MACH-105213 - english	<a href="#">Fundamentals of Combustion I</a>			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
- NO<sub>x</sub> 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

**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

**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
- NO<sub>x</sub> 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

**6.75 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	3166550	<a href="#">Fundamentals of Combustion II</a>	2 SWS	Lecture / 🗣️	Yu
ST 2026	3166551	<a href="#">Fundamentals of Combustion II (Exercises)</a>	2 SWS	Practice / 🗣️	Yu
Exams					
WT 25/26	76-T-MACH-114044	<a href="#">Fundamentals of Combustion II</a>			Bykov
ST 2026	76-T-MACH-114044	<a href="#">Fundamentals of Combustion II</a>			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, Berkeley 2006

**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

**6.76 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2166538	<a href="#">Fundamentals of combustion II</a>	2 SWS	Lecture /	Yu, Bykov
ST 2026	2166539	<a href="#">Übung zu Grundlagen der technischen Verbrennung II</a>	2 SWS	Practice /	Bykov
Exams					
WT 25/26	76-T-MACH-105325	<a href="#">Fundamentals of Combustion II</a>			Bykov
ST 2026	76-T-MACH-105325	<a href="#">Fundamentals of Combustion II</a>			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, Berkeley 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

**6.77 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	4044021	<a href="#">KSOP - Fundamentals of Optics &amp; Photonics</a>	4 SWS	Lecture / 🗎	Kreysing, Lemmer
WT 25/26	4044022	<a href="#">KSOP - Exercises to Fundamentals of Optics &amp; Photonics</a>	2 SWS	Practice / 🗎	Unni Chorakkunnath, Hunger, Kreysing
Exams					
WT 25/26	7800046	<a href="#">Fundamentals of Optics and Photonics - Exam 2</a>			Hunger, Lemmer, Kreysing
WT 25/26	7800058	<a href="#">Fundamentals of Optics and Photonics - Exam 1</a>			Hunger, Lemmer, Kreysing

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

**Prerequisites**

Successful 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



## 6.78 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-103715 - Technical Specialisation](#)

Type	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

Courses					
WT 25/26	4044021	<a href="#">KSOP - Fundamentals of Optics &amp; Photonics</a>	4 SWS	Lecture / 	Kreysing, Lemmer
WT 25/26	4044022	<a href="#">KSOP - Exercises to Fundamentals of Optics &amp; Photonics</a>	2 SWS	Practice / 	Unni Chorakkunnath, Hunger, Kreysing
Exams					
WT 25/26	7800057	<a href="#">Fundamentals of Optics &amp; Photonics - Exercises</a>			Hunger, Kreysing, Lemmer

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

### Prerequisites


none

T

## 6.79 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2182310	<a href="#">Fundamentals of Phase-Field Modelling</a>	3 SWS	Lecture / Practice / 	Schneider
Exams					
WT 25/26	76-T-MACH-114627	<a href="#">Fundamentals of Phase-Field Modelling</a>			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-Hilliard, 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

**6.80 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-103741 - Functional Materials](#)

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

Exams			
WT 25/26	7313734	<a href="#">Fundamentals on Plasma Technology</a>	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

**6.81 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2183721	<a href="#">High Performance Computing</a>	3 SWS	Lecture / Practice / X	Nestler, Selzer
ST 2026	2183721	<a href="#">High Performance Computing</a>	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 knowledge 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



## 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


## 6.82 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-103738 - Structural Materials](#)

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

Courses					
ST 2026	2126749	<a href="#">Advanced powder metals</a>	2 SWS	Lecture / 	Schell
Exams					
WT 25/26	76-T-MACH-102157	<a href="#">High Performance Powder Metallurgy Materials</a>	Schell		
ST 2026	76-T-MACH-102157	<a href="#">High Performance Powder Metallurgy Materials</a>	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. Thümmeler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

## T

**6.83 Module component: High Temperature Corrosion [T-MACH-113598]**

**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2193055	<a href="#">High Temperature Corrosion</a>	2 SWS	Lecture / 🎧	Gorr
Exams					
WT 25/26	76-T-MACH-113598	<a href="#">High Temperature Corrosion</a>			Gorr
ST 2026	76-T-MACH-113598	<a href="#">High Temperature Corrosion</a>			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**

2193055, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)  
On-Site**

**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](mailto:sabine.deubig@kit.edu) und [bronislava.gorr@kit.edu](mailto:bronislava.gorr@kit.edu)

**Literature**

- Birks, N., Meier, G.H. and Pettit, F.S., Introduction to the High Temperature Oxidation of Metals, Cambridge University Press, (Cambridge, 2006)
- Kofstad, P., High Temperature Corrosion, Elsevier Applied Science, (London, 1988)


## T

**6.84 Module component: High Temperature Materials [T-MACH-105459]**

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

**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2174605	<a href="#">High Temperature Materials</a>	2 SWS	Lecture / 	Heilmaier
Exams					
WT 25/26	76-T-MACH-105459	<a href="#">High Temperature Materials</a>			Heilmaier
ST 2026	76-T-MACH-105459	<a href="#">High Temperature Materials</a>			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. Ilchner, Hochtemperaturplastizität, Springer-Verlag, Berlin

M.E. Kassner, Fundamentals of Creep in Metals and Alloys, Elsevier, Amsterdam, 2009

T


## 6.85 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2109031	<a href="#">Human Factors Engineering I (Workplace Design)</a>	2 SWS	Lecture / 	Deml
Exams					
WT 25/26	76-T-MACH-114175	<a href="#">Human Factors Engineering I (Workplace Design)</a>			Deml
ST 2026	76-T-MACH-114175	<a href="#">Human Factors Engineering I (Workplace Design)</a>			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


## 6.86 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2109032	<a href="#">Human Factors Engineering II (Organizational Design)</a>	2 SWS	Lecture / 	Deml
Exams					
WT 25/26	76-T-MACH-114176	<a href="#">Human Factors Engineering II (Organizational Design)</a>			Deml
ST 2026	76-T-MACH-114176	<a href="#">Human Factors Engineering II (Organizational Design)</a>			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

## 6.87 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2306321	<a href="#">Hybrid and Electric Vehicles</a>	2 SWS	Lecture / 	Doppelbauer
WT 25/26	2306323	<a href="#">Tutorial for 2306323 Hybrid and Electric Vehicles</a>	1 SWS	Practice / 	Doppelbauer
Exams					
WT 25/26	7306321	<a href="#">Hybrid and Electric Vehicles</a>			Doppelbauer
ST 2026	7306321	<a href="#">Hybrid and Electric Vehicles</a>			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

**6.88 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-103741 - Functional Materials](#)

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

Exams			
WT 25/26	7100039	<a href="#">Hydrogen as Energy Carrier</a>	Ehrenberg

**Assessment**

Oral exam, about 25 minutes

**Workload**


120 hours

## T

**6.89 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-103738 - Structural Materials](#)

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	4 CP	pass/fail	Each summer term	1 semesters	3

Courses					
ST 2026	2173584	<a href="#">Hydrogen in Materials – Exercises and Lab Course</a>	2 SWS	Practice / 	Wagner
Exams					
ST 2026	76-T-MACH-112159	<a href="#">Hydrogen in Materials – Exercises and Lab Course</a>			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

**6.90 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-103738 - Structural Materials](#)

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	4 CP	pass/fail	Each winter term	1 semesters	2

Courses					
WT 25/26	2174573	<a href="#">Hydrogen in Materials – Exercises and Lab Course</a>	2 SWS	Practice /	Wagner, Pundt
Exams					
WT 25/26	76-T-MACH-112942	<a href="#">Hydrogen in Materials – Exercises and Lab Course</a>			Wagner
ST 2026	76-T-MACH-112942	<a href="#">Hydrogen in Materials – Exercises and Lab Course</a>			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

## 6.91 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-103738 - Structural Materials](#)


**Type**  
Oral examination

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

Courses					
ST 2026	2173588	<a href="#">Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</a>	2 SWS	Lecture / 	Pundt, Wagner
Exams					
WT 25/26	76-T-MACH-110923	<a href="#">Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</a>			Pundt
ST 2026	76-T-MACH-110923	<a href="#">Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</a>			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**  
 2173588, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

This lecture teaches physical and chemical basics of hydrogen adsorption and absorption of different materials. It trains the understanding of the specific lattice positions that hydrogen occupies within solids, and its impact on material properties. A thermodynamical approach yields Sievert's law, allowing the students to describe the different solubilities of hydrogen (and other gases) in solid materials. Further thermodynamic data can be obtained using van't Hoff plots of phase transformation pressures. The impact of ternary alloy components, as described by semi-empirical models, will be recognized. The specific mobility of hydrogen in materials will be understood, which divides into classical diffusion and quantum mechanical tunneling processes. The students can describe the interaction of hydrogen with defects in crystal lattices, which is of special interest for properties of nano-scale materials or for the hydrogen embrittlement of steels. Basic embrittlement models can be explained by the students. Actual hydrogen storage systems can be summarized.

learning objectives:

- o Hydrogen as energy storage – the hydrogen cycle and safety issues
- o methods for hydrogen charging of materials and hydrogen detection
- o Hydrogen adsorption at and absorption in different solids, Sievert's law
- o interstitial lattice sites and lattice expansion
- o Hydrides, van't Hoff plots, phase transitions, M-H binary phase diagrams
- o ternary alloy effects
- o hydrogen mobility in materials: interstitial diffusion and quantum mechanical tunneling
- o interaction of hydrogen with defects
- o hydrogen embrittlement of steels, different embrittlement models
- o hydrogen in nano-scale systems and new storage materials

**Literature**


Literaturhinweise und Unterlagen in der Vorlesung





T

**6.92 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2174572	<a href="#">Hydrogen in Materials: from energy storage to hydrogen embrittlement</a>	2 SWS	Lecture / 	Pundt, Wagner
Exams					
WT 25/26	76-T-MACH-110957	<a href="#">Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</a>			Pundt
ST 2026	76-T-MACH-110957	<a href="#">Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</a>			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**

2174572, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

This lecture teaches physical and chemical basics of hydrogen adsorption and absorption of different materials. It trains the understanding of the specific lattice positions that hydrogen occupies within solids, and its impact on material properties. A thermodynamical approach yields Sievert's law, allowing the students to describe the different solubilities of hydrogen (and other gases) in solid materials. Further thermodynamic data can be obtained using van't Hoff plots of phase transformation pressures. The impact of ternary alloy components, as described by semi-empirical models, will be recognized. The specific mobility of hydrogen in materials will be understood, which divides into classical diffusion and quantum mechanical tunneling processes. The students can describe the interaction of hydrogen with defects in crystal lattices, which is of special interest for properties of nano-scale materials or for the hydrogen embrittlement of steels. Basic embrittlement models can be explained by the students. Actual hydrogen storage systems can be summarized.

learning objectives:

- o Hydrogen as energy storage – the hydrogen cycle and safety issues
- o methods for hydrogen charging of materials and hydrogen detection
- o Hydrogen adsorption at and absorption in different solids, Sievert's law
- o interstitial lattice sites and lattice expansion
- o Hydrides, van't Hoff plots, phase transitions, M-H binary phase diagrams
- o ternary alloy effects
- o hydrogen mobility in materials: interstitial diffusion and quantum mechanical tunneling
- o interaction of hydrogen with defects
- o hydrogen embrittlement of steels, different embrittlement models
- o hydrogen in nano-scale systems and new storage materials

**Literature**

Literaturhinweise und Unterlagen in der Vorlesung

T

## 6.93 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-103741 - Functional Materials](#)





**Type**  
Oral examination

**Credits**  
6 CP

**Grading**  
graded

**Version**  
1

Courses					
WT 25/26	2309440	<a href="#">Integrated Photonics</a>	2 SWS	Lecture / 	Koos, N.N.
WT 25/26	2309441	<a href="#">Tutorial to Integrated Photonics</a>	2 SWS	Practice / 	Koos, N.N., Khairy
Exams					
WT 25/26	7300021	<a href="#">Integrated Photonics</a>			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

**6.94 Module component: Internship [T-MACH-107764]**

**Coordinators:** Dr. Patric Gruber  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103838 - Internship](#)

Type	Credits	Grading	Term offered	Version
Coursework	12 CP	pass/fail	Each term	2

Exams				
WT 25/26	76-T-MACH-107764	<a href="#">Internship</a>		Gruber
ST 2026	76-T-MACH-107764	<a href="#">Internship</a>		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 § 14a. 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

**6.95 Module component: Introduction to Bionics [T-MACH-111807]**

**Coordinators:** apl. Prof. Dr. Hendrik Hölscher  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2142151	<a href="#">Introduction to Biomimetics</a>	2 SWS	Lecture / 🗎	Hölscher
Exams					
WT 25/26	76-T-MACH-102172	<a href="#">Introduction into Biomimetics</a>			Hölscher
ST 2026	76-T-MACH-102172	<a href="#">Introduction into Biomimetics</a>			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 successful attendance 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


## 6.96 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2141861	<a href="#">Introduction to Microsystem Technology I</a>	2 SWS	Lecture / 	Korvink, Badilita
Exams					
WT 25/26	76-T-MACH-114100	<a href="#">Introduction to Microsystem Technology I</a>	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


**6.97 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-103740 - Materials Processing](#)

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

Courses					
ST 2026	2142874	<a href="#">Introduction to Microsystem Technology II</a>	2 SWS	Lecture / 	Korvink, Badilita
Exams					
WT 25/26	76-T-MACH-114101	<a href="#">Introduction to Microsystem Technology II</a>			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


## 6.98 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2162282	<a href="#">Introduction to the Finite Element Method</a>	2 SWS	Lecture / 	Langhoff, Böhlke
Exams					
WT 25/26	76-T-MACH-105320	<a href="#">Introduction to the Finite Element Method</a>	Böhlke, Langhoff		

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

### Assessment

written exam, 90 min, graded; Additives as announced

### Prerequisites

Coursework in *Tutorial Introduction to the Finite Element Method* (T-MACH-110330) must be passed

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-110330 - Tutorial Introduction to the Finite Element Method](#) must have been passed.

### Additional Information

The corresponding course is offered in German.

### Workload

90 hours

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

V

## Introduction to the Finite Element Method

2162282, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

### Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations


### Literature





- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- Jung, M., Langer, U.: Methode der finiten Elemente für Ingenieure: Eine Einführung in die numerischen Grundlagen und Computersimulation, Teubner 2013
- Braess, D.: Finite Elemente -- Theorie, schnelle Löser und Anwendungen in der Elastizitätstheorie, Springer 2013
- Gustafsson, B.: Fundamentals of Scientific Computing, Springer 2011

## T

**6.99 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2182732	<a href="#">Introduction to Theory of Materials</a>	2 SWS	Lecture / 	Kamlah
Exams					
WT 25/26	76-T-MACH-105321	<a href="#">Introduction to Theory of Materials</a>			Kamlah
ST 2026	76-T-MACH-105321	<a href="#">Introduction to Theory of Materials</a>			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

**6.100 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-103738 - Structural Materials](#)

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

Courses					
ST 2026	2182101	<a href="#">Laboratory "Failure Analysis"</a>	2 SWS	Practical course / 	Greiner, Schneider, Dollmann
Exams					
ST 2026	76-T-MACH-114609	<a href="#">Lab Course in Failure Analysis</a>			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](mailto: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

**6.101 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-103740 - Materials Processing](#)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	Graded	Each summer term	5

Courses					
ST 2026	2150550	<a href="#">Laboratory Production Metrology</a>	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 a 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
- Coordinate 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 assess 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](http://www.wbk.kit.edu/studium-und-lehre.php)).

**Literature**

Skript zur Veranstaltung wird über (<https://ilias.studium.kit.edu/>) bereitgestellt. Ebenso wird auf gängige Fachliteratur verwiesen.

Lecture notes will be provided in Ilias (<https://ilias.studium.kit.edu/>). Additional reference to literature will be provided, as well.

T

**6.102 Module component: Laser Material Processing [T-MACH-112763]****Coordinators:** Dr.-Ing. Johannes Schneider**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
ST 2026	2182642	<a href="#">Laser Material Processing</a>	2 SWS	Lecture /	Schneider
Exams					
WT 25/26	76-T-MACH-112763	<a href="#">Laser Material Processing</a>			Schneider
ST 2026	76-T-MACH-112763	<a href="#">Laser Material Processing</a>			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].

**Recommendations**

preliminary knowledge 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-, CO<sub>2</sub>-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in material processing
- safety 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-, CO<sub>2</sub>- 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

**6.103 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-103740 - Materials Processing](#)

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

Courses					
ST 2026	2303200	<a href="#">Laser Metrology</a>	2 SWS	Lecture /	Eichhorn
Exams					
WT 25/26	7303200	<a href="#">Laser Metrology</a>			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 announced in ILIAS. Exam registration will also be organised via ILIAS.

T

## 6.104 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-103741 - Functional Materials](#)

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

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

2193013, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Registration via ILIAS or by e-mail to: [pflueging@kit.edu](mailto:pflueging@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 [pflging@kit.edu](mailto:pflging@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

**6.105 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	<a href="#">Lecture series Science in Society</a>	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**1130716, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)  
On-Site****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

**6.106 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2313747	<a href="#">Light and Display Engineering</a>	2 SWS	Lecture / 	Kling
WT 25/26	2313749	<a href="#">Practical Exercises to 2313747</a> <a href="#">Light and Display Engineering</a>	1 SWS	Practice / 	Kling
Exams					
WT 25/26	7313747	<a href="#">Light and Display Engineering</a>	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


## 6.107 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2113111	<a href="#">Lightweight Design Workshop: Simulation and Manufacturing</a>	4 SWS	Lecture / Practice / 	Kärger, Liebig
Exams					
WT 25/26	76-T-MACH-114439	<a href="#">Lightweight Design Workshop: Simulation and Manufacturing</a>			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

**6.108 Module component: Master's Thesis [T-MACH-107759]**

**Coordinators:** Prof. Dr. Astrid Pundt  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103835 - Master's Thesis](#)

Type	Credits	Grading	Term offered	Version
Final Thesis	30 CP	graded	Each term	3

**Assessment**

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 or a senior scientist according to § 14 Abs. 3 Ziff. 1 KITG or habilitated members 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.

**Prerequisites**

The requirement for admission to the master thesis module are 75 ECTS. As to exceptions, the examination board decides on a request of the student (see § 14 (1) SPO).

**Modeled Prerequisites**

The following conditions have to be fulfilled:

- You need to have earned at least 75 credits in the following fields:
  - Internship
  - Interdisciplinary Supplement
  - Materials Science Major Course
  - Focal Course I
  - Focal Course II
  - Interdisciplinary Qualifications

**Final Thesis**

This module component represents a final thesis. The following periods have been supplied:

<b>Submission deadline</b>	6 months
<b>Maximum extension period</b>	3 months
<b>Correction period</b>	8 weeks

**Workload**

900 hours

T

## 6.109 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-103740 - Materials Processing](#)


**Type**  
Oral examination





**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

Courses					
ST 2026	2245840	<a href="#">Materials and Processes for Electrochemical Storage</a>	2 SWS	Lecture / 	Tübke
Exams					
WT 25/26	7245840	<a href="#">Materials for Electrochemical Storage</a>			Tübke
ST 2026	7245840	<a href="#">Materials and Processes for Electrochemical Storage</a>			Tübke

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

### Assessment

Learning control is an oral exam lasting approx. 30 minutes.

### Prerequisites

None

## T

**6.110 Module component: Materials Characterization [T-MACH-107684]**

**Coordinators:** Dr.-Ing. Jens Gibmeier  
Prof. Dr. Reinhard Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103714 - Materials Characterization](#)

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

Exams				
WT 25/26	76-T-MACH-107684	<a href="#">Materials Characterization</a>		Gibmeier
ST 2026	76-T-MACH-107684	<a href="#">Materials Characterization</a>		Gibmeier

**Assessment**

Oral exam, about 25 minutes

**Prerequisites**

Successful participation in Übungen zu Werkstoffanalytik is the condition for the admittance to the oral exam in Werkstoffanalytik.

T-MACH-110945 – Exercises for Materials Characterization has not been started.

T-MACH-110946 – Materials Characterization has not been started.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-107685 - Exercises for Materials Characterization](#) must have been passed.
2. The module component [T-MACH-110945 - Exercises for Materials Characterization](#) must not have been started.
3. The module component [T-MACH-110946 - Materials Characterization](#) must not have been started.

**Additional Information**

The course is offered in German.

**Workload**

120 hours

## T



**6.111 Module component: Materials Characterization [T-MACH-110946]**

**Coordinators:** Dr.-Ing. Jens Gibmeier  
Prof. Dr. Reinhard Schneider

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103714 - Materials Characterization](#)

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

Courses					
WT 25/26	2173431	<a href="#">Materials Characterization</a>	2 SWS	Lecture / 	Gibmeier, Peterlechner
ST 2026	2173431	<a href="#">Materials Characterization</a>	2 SWS	Lecture / 	Gibmeier, Peterlechner
Exams					
WT 25/26	76-T-MACH-110946	<a href="#">Materials Characterization</a>			Gibmeier
ST 2026	76-T-MACH-110946	<a href="#">Materials Characterization</a>			Gibmeier

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

**Assessment**

Oral exam, about 25 minutes

**Prerequisites**

Successful participation in Exercises for Materials Characterization is the condition for the admittance to the oral exam in Materials Characterization.

T-MACH-107685 – Übungen zu Werkstoffanalytik has not been started.

T-MACH-107684 – Werkstoffanalytik has not been started.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-110945 - Exercises for Materials Characterization](#) must have been passed.
2. The module component [T-MACH-107685 - Exercises for Materials Characterization](#) must not have been started.
3. The module component [T-MACH-107684 - Materials Characterization](#) must not have been started.

**Additional Information**

The course is offered in English.

**Workload**

120 hours

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

## V

**Materials Characterization**

2173431, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

**Content**

The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

**learning objectives:**

The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.

**Literature**

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

**V****Materials Characterization**

2173431, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)  
On-Site****Content**

The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

**learning objectives:**

The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.

**Literature**

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T


**6.112 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2173600	<a href="#">Materials in Additive Manufacturing</a>	2 SWS	Lecture / 	Dietrich
Exams					
WT 25/26	76-T-MACH-110165	<a href="#">Materials in Additive Manufacturing</a>			Dietrich
ST 2026	76-T-MACH-110165	<a href="#">Materials in Additive Manufacturing</a>			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

## 6.113 Module component: Materials Modelling: Dislocation Based Plasticity [T-MACH-105369]

**Coordinators:** Dr. Daniel Weygand

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2182740	<a href="#">Materials modelling: dislocation based plasticity</a>	2 SWS	Lecture /	Weygand
Exams					
WT 25/26	76-T-MACH-105369	<a href="#">Materials Modelling: Dislocation Based Plasticity</a>			Weygand
WT 25/26	76-T-MACH-105369_WS	<a href="#">Materials Modelling: Dislocation Based Plasticity</a>			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


## 6.114 Module component: Materials of Lightweight Construction [T-MACH-105211]





**Coordinators:** Dr.-Ing. Wilfried Liebig

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2174574	<a href="#">Materials of Lightweight Construction</a>	2 SWS	Lecture / 	Liebig
Exams					
WT 25/26	76-T-MACH-105211	<a href="#">Materials of Lightweight Construction</a>			Liebig
ST 2026	76-T-MACH-105211	<a href="#">Materials of Lightweight Construction</a>			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-oriented and material aspects of lightweight construction

Aluminium-based alloys

Aluminium wrought alloys

Aluminium cast alloys

Magnesium-based alloys

Magnesium wrought alloys

Magnesium cast alloys

Titanium-based alloys

Titanium wrought alloys

Titanium cast alloys

High-strength steels

High-strength structural steels,

Heat-treatable steels, press-hardening and hardenable steels

Composites - mainly PMC

Matrices

Reinforcements

Basic mechanical principles of composites

Hybrid composites

Special materials for lightweight design

Beryllium alloys

Metallic Glasses

Applications

**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

## 6.115 Module component: Materials Recycling and Sustainability [T-MACH-110937]

**Coordinators:** Dr.-Ing. Wilfried Liebig

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
ST 2026	2173520	<a href="#">Materials Recycling and Sustainability</a>	2 SWS	Lecture /	Liebig
Exams					
WT 25/26	76-T-MACH-110937	<a href="#">Materials Recycling and Sustainability</a>			Liebig
ST 2026	76-T-MACH-110937	<a href="#">Materials Recycling and Sustainability</a>			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





T

## 6.116 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162280	<a href="#">Mathematical Methods in Micromechanics</a>	2 SWS	Lecture / 	Böhlke, Kehrler

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

**6.117 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	3137020	<a href="#">Measurement and Control Systems</a>	3 SWS	Lecture / 	Stiller
WT 25/26	3137021	<a href="#">Measurement and Control Systems (Tutorial)</a>	1 SWS	Practice / 	Stiller
Exams					
WT 25/26	76-T-MACH-103622	<a href="#">Measurement and Control Systems</a>	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 measurement

**Lernziele (EN):**

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

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



### 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


## 6.118 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2178420	<a href="#">Mechanical Properties of Nanomaterials and Microsystems</a>	2 SWS	Lecture / 	Kirchlechner, Gruber, Weygand
Exams					
WT 25/26	76-T-MACH-114018	<a href="#">Mechanical Properties of Nanomaterials and Microsystems</a>			Kirchlechner, Weygand, Gruber
ST 2026	76-T-MACH-114018	<a href="#">Mechanical Properties of Nanomaterials and Microsystems</a>			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

2178420, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### **Content**

1. Introduction: Application and properties of micro- and nanosystems; Overview on size effects
2. Fundamentals: Dislocation plasticity (definition of a dislocation; dislocation density, mobility, dislocation sources, statistical aspects incl. SSDs and GNDs).
3. Single crystal plasticity: mechanical and microstructure characterization, mechanisms and their size dependence.
4. Interface plasticity: Compatibility, slip transfer mechanisms, expected size effects.
5. Modelling of mechanisms causing size effects in crystals and at grain boundaries, e.g. dislocation dynamics.
6. Thin film materials: synthesis, characterization and mechanical properties.
7. Nanocrystalline materials: Synthesis, outstanding mechanical properties
8. Elektro-mechanical conversion: piezo-resistive, piezo-elektric, elektrostatic, ...
9. Actuation: inverse piezoelectric effect, shape-memory, electromagnetic, ...

The students know and understand size and scaling effects in micro- and nanosystems based on the fundamental microstructure mechanisms at play. They can describe the mechanical behavior of nano- and microstructured materials and analyze and explain the origin for the differences compared to classical material behavior. They are able to explain suitable processing routes, experimental characterization techniques and adequate modelling schemes for nano- and microstructured materials. They also understand the relevance of mechanical phenomena in small dimensions and can judge how they determine material processing as well the performance and the design of microsensors and microactuators.

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

### **Organizational issues**

The first lecture will take place on April 30, 2025.

### **Literature**

1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials

T


**6.119 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2177013	<a href="#">Mechanical Properties of Nanomaterials and Microsystems</a>	2 SWS	Lecture / 	Kirchlechner, Gruber, Greiner, Weygand
Exams					
WT 25/26	76-T-MACH-114071	<a href="#">Mechanical Properties of Nanomaterials and Microsystems</a>			Gruber, Kirchlechner, Weygand
ST 2026	76-T-MACH-114071	<a href="#">Mechanical Properties of Nanomaterials and Microsystems (in German)</a>			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 Mechanical Parameters such as Young's Modulus and Yield Strength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Electrostatics,...
8. Actuation: Inverse Piezo-electric Effect, Shape Memory, Electromagnetic 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

**6.120 Module component: Metal Forming [T-MACH-105177]****Coordinators:** Prof. Dr.-Ing. Thomas Herlan**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
ST 2026	2150681	<a href="#">Metal Forming</a>	2 SWS	Lecture / 	Herlan
Exams					
WT 25/26	76-T-MACH-105177	<a href="#">Metal Forming</a>			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


**6.121 Module component: Micro Magnetic Resonance [T-MACH-105782]**





**Coordinators:** Prof. Dr. Jan Gerrit Korvink  
Dr. Neil MacKinnon

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2141501	<a href="#">Micro Magnetic Resonance</a>	2 SWS	Seminar / 	MacKinnon, Badilita, Jouda, Korvink
Exams					
WT 25/26	76-T-MACH-105782	<a href="#">Micro Magnetic Resonance</a>			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


## 6.122 Module component: Microstructure-Property-Relationships [T-MACH-110931]





**Coordinators:** Dr. Patric Gruber  
Prof. Dr. Christoph Kirchlechner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103713 - Properties](#)

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

Courses					
WT 25/26	2177020	<a href="#">Microstructure-Property-Relationships</a>	3 SWS	Lecture / 	Kirchlechner, Avadani, Bansal, Sarebanzadeh, Vrellou, Gruber
Exams					
WT 25/26	76-T-MACH-110931	<a href="#">Microstructure-Property-Relationships</a>			Kirchlechner, Gruber
ST 2026	76-T-MACH-110931	<a href="#">Microstructure-Property-Relationships</a>			Gruber, Kirchlechner

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

### Assessment

Oral examination (about 30 min)

### Prerequisites

The successful participation in Exercises for Microstructure-Properties-Relationships is the condition for the admittance to the oral exam in Microstructure-Properties-Relationships.

T-MACH-107683 - Übungen zu Gefüge-Eigenschafts-Beziehungen has not been started.

T-MACH-107604 - Gefüge-Eigenschafts-Beziehungen has not been started.

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-110930 - Exercises for Microstructure-Property-Relationships](#) must have been passed.
2. The module component [T-MACH-107683 - Exercises for Microstructure-Property-Relationships](#) must not have been started.
3. The module component [T-MACH-107604 - Microstructure-Property-Relationships](#) 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

### 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

## 6.123 Module component: Microstructure-Property-Relationships [T-MACH-107604]

**Coordinators:** Dr. Patric Gruber  
Prof. Dr. Christoph Kirchlechner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103713 - Properties](#)

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

Courses					
ST 2026	2178124	<a href="#">Microstructure-Property-Relationships</a>	3 SWS	Lecture / 🎤	Kirchlechner, Gruber
Exams					
WT 25/26	76-T-MACH-107604	<a href="#">Microstructure-Properties-Relationships</a>			Kirchlechner, Gruber
ST 2026	76-T-MACH-107604	<a href="#">Microstructure-Property-Relationships</a>			Kirchlechner, Gruber

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

### Assessment

Oral examination (about 30 min)

### Prerequisites

The successful participation in Übungen zu Gefüge-Eigenschafts-Beziehungen is the condition for the admittance to the oral exam in Gefüge-Eigenschafts-Beziehungen.

T-MACH-110930 - Exercises for Microstructure-Properties-Relationships has not been started.

T-MACH-110931 - Microstructure-Properties-Relationships has not been started.

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107683 - Exercises for Microstructure-Property-Relationships](#) must have been passed.
2. The module component [T-MACH-110930 - Exercises for Microstructure-Property-Relationships](#) must not have been started.
3. The module component [T-MACH-110931 - Microstructure-Property-Relationships](#) 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

## 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 propeties 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****6.124 Module component: Microsystem Simulation [T-MACH-108383]****Coordinators:** Prof. Dr. Jan Gerrit Korvink**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103739 - Computational Materials Science](#)

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****6.125 Module component: Modern Characterization Methods for Materials and Catalysts [T-CHEMBIO-107822]****Organisation:** KIT Department of Chemistry and Biosciences**Part of:** [M-MACH-103741 - Functional Materials](#)

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

T


**6.126 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2181750	<a href="#">Multi-scale Plasticity</a>	2 SWS	Lecture / 	Greiner, Schulz
Exams					
WT 25/26	76-T-MACH-105516	<a href="#">Multi-Scale Plasticity</a>			Schulz, Greiner

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

**Assessment**

oral exam, about 30 min

**Prerequisites**

none

**Recommendations**

preliminary knowledge 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](mailto:katrin.schulz@kit.edu) bis zum 20.10.2025

T

**6.127 Module component: Nano-Optics [T-PHYS-102282]**

**Coordinators:** PD Dr. Andreas Naber  
**Organisation:** KIT Department of Physics  
**Part of:** [M-MACH-103741 - Functional Materials](#)

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

Courses					
WT 25/26	4020021	<a href="#">Nano-Optics</a>	3 SWS	Lecture / 🌐	Naber
WT 25/26	4020022	<a href="#">Exercises to Nano-Optics</a>	1 SWS	Practice / 🌐	Naber
Exams					
WT 25/26	7800099	<a href="#">Nano-Optics</a>			Naber

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

**Prerequisites**


none





## T

**6.128 Module component: Non-destructive Materials Testing [T-MACH-114968]**

**Coordinators:** Dr.-Ing. Stefan Dietrich  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2174512	<a href="#">Non-destructive Materials Testing</a>	4 SWS	Lecture / 	Dietrich
Exams					
ST 2026	76-T-MACH-114968	<a href="#">Non-destructive Materials Testing</a>			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**

2174512, SS 2026, 4 SWS, Language: German, [Open in study portal](#)

**Lecture (V)  
On-Site**

**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


**6.129 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-103738 - Structural Materials](#)

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

Courses					
ST 2026	2174555	<a href="#">Non-ferrous Metals and alloys</a>	3 SWS	Lecture / 	Heilmaier, White
Exams					
ST 2026	76-T-MACH-114956	<a href="#">Non-ferrous Metals and Alloys</a>			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**

2174555, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

**Lecture (V)  
On-Site**

**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

**6.130 Module component: Nonlinear Continuum Mechanics [T-MACH-111026]****Coordinators:** Prof. Dr.-Ing. Thomas Böhlke**Organisation:****Part of:** [M-MACH-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162344	<a href="#">Nonlinear Continuum Mechanics</a>	2 SWS	Lecture / 🗣️	Böhlke
Exams					
WT 25/26	76-T-MACH-111026	<a href="#">Nonlinear Continuum Mechanics</a>			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 recommended 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


**6.131 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2141865	<a href="#">Novel actuators and sensors</a>	2 SWS	Lecture / 	Kohl, Sommer
Exams					
WT 25/26	76-T-MACH-102152	<a href="#">Novel Actuators and Sensors</a>			Kohl, Sommer
ST 2026	76T-MACH-102152_2	<a href="#">Novel Actuators and Sensors</a>			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



## 6.132 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2302150	<a href="#">Optical Engineering and Machine Vision</a>	3 SWS	Lecture / 	Heizmann
WT 25/26	2302151	<a href="#">Tutorial to 2302150 Optical Engineering and Machine Vision</a>	1 SWS	Practice / 	Leyer
Exams					
WT 25/26	7302150	<a href="#">Optical Engineering and Machine Vision</a>	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

## 6.133 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2309460	<a href="#">Optical Transmitters and Receivers</a>	2 SWS	Lecture / 	Freude
WT 25/26	2309461	<a href="#">Tutorial for 2309460 Optical Transmitters and Receivers</a>	2 SWS	Practice / 	Freude, N.N.
Exams					
WT 25/26	7309460	<a href="#">Optical Transmitters and Receivers</a>			Freude
ST 2026	7309460	<a href="#">Optical Transmitters and Receivers</a>			Freude

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

**Assessment**

Access controll takes place in 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



## 6.134 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2313770	<a href="#">Opto- and Nanoelectronic Devices</a>	3 SWS	Lecture / 	Lemmer
ST 2026	2313771	<a href="#">Exercise for 2313770 Opto- and Nanoelectronic Devices</a>	1 SWS	Practice / 	Lemmer
Exams					
ST 2026	7313707	<a href="#">Opto- and Nanoelectronic Devices</a>			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

**6.135 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2309486	<a href="#">Optoelectronic Components</a>	2 SWS	Lecture / 	Huber-Loyola
ST 2026	2309487	<a href="#">Optoelectronic Components (Tutorial)</a>	1 SWS	Practice / 	Huber-Loyola
Exams					
WT 25/26	7300023	<a href="#">Optoelectronic Components</a>			Randel
WT 25/26	7309486	<a href="#">Optoelectronic Components</a>			Randel
ST 2026	7309486	<a href="#">Optoelectronic Components</a>			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

**6.136 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2313768	<a href="#">Organic and Flexible Electronics</a>	2 SWS	Lecture / 	Hernandez Sosa
Exams					
WT 25/26	7313710	<a href="#">Organic and Flexible Electronics</a>			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


## 6.137 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2181740	<a href="#">Particle Dynamics and Atomistic Simulation</a>	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

**6.138 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-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2173421	<a href="#">Phase Transformations in Materials</a>	3 SWS	Lecture / 	Heilmaier, Sen
Exams					
WT 25/26	76-T-MACH-111391	<a href="#">Phase Transformations in Materials</a>			Heilmaier, Sen
ST 2026	76-T-MACH-111391	<a href="#">Phase Transformations in Materials</a>			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
  - Solidification 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](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

## 6.139 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2183705	<a href="#">Phase-field method in thermomechanics</a>	3 SWS	Lecture / 	Prahs
Exams					
WT 25/26	76-T-MACH-113694	<a href="#">Phasenfeldmethode in der Thermomechanik</a>			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

**6.140 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2313737	<a href="#">Photovoltaics</a>	3 SWS	Lecture / 	Powalla, Lemmer
ST 2026	2313738	<a href="#">Tutorial 2313737 Photovoltaik</a>	1 SWS	Practice / 	Powalla, Lemmer
Exams					
WT 25/26	7313737	<a href="#">Photovoltaics</a>			Powalla, Lemmer
ST 2026	7313737	<a href="#">Photovoltaics</a>			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****6.141 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2189906	<a href="#">Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle</a>	2 SWS	Lecture / 	Dagan, Metz
Exams					
WT 25/26	76-T-MACH-105537	<a href="#">Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle</a>			Dagan

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

oral exam, approx. 30 min.

**Prerequisites**

none

**Workload**

120 hours

*Below you will find excerpts from courses related to this module component:***V****Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle****Lecture (V)  
On-Site**2189906, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Content**

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima .
- Fission , chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

**The students**

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h

self study 46 h

oral exam about 20 min.

**Literature**

AEA öffentliche Dokumentation zu den nukleare Ereignissen

K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker: Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley \$ Sons , Inc. 1975 (in Englisch)



R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in Englisch)





J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in Englisch)

T

**6.142 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-103741 - Functional Materials](#)

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


**6.143 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-103738 - Structural Materials](#)

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	Graded	Each summer term	1

Courses					
ST 2026	2173648	<a href="#">Plasticity of Metals and Intermetallics</a>	4 SWS	Lecture / 	Heilmaier, Schliephake, Sen
Exams					
WT 25/26	76-T-MACH-110818	<a href="#">Plasticity of Metals and Intermetallics</a>			Heilmaier, Schliephake
ST 2026	76-T-MACH-110818	<a href="#">Plasticity of Metals and Intermetallics</a>			Heilmaier, Schliephake
ST 2026	76-T-MACH-110818-W	<a href="#">Plasticity of Metals and Intermetallics</a>			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 via 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

**6.144 Module component: Polymer Engineering I [T-MACH-102137]****Coordinators:** Dr.-Ing. Wilfried Liebig**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2173590	<a href="#">Polymer Engineering I</a>	2 SWS	Lecture / 	Liebig
Exams					
WT 25/26	76-T-MACH-102137	<a href="#">Polymer Engineering I</a>			Liebig
ST 2026	76-T-MACH-102137	<a href="#">Polymer Engineering I</a>			Liebig

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

Oral exam, about 25 minutes

**Prerequisites**

T-MACH-114007 must not have been started

**Additional Information**

The course is offered in German.

**Workload**

120 hours

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

V

**Polymer Engineering I**2173590, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)  
On-Site**

**Content**

1. Economical aspects of polymers
2. Introduction of mechanical, chemical and 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 electrical properties 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

**6.145 Module component: Polymer Engineering II [T-MACH-102138]****Coordinators:** Dr.-Ing. Wilfried Liebig**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
ST 2026	2174596	<a href="#">Polymer Engineering II</a>	2 SWS	Lecture / 	Liebig
Exams					
WT 25/26	76-T-MACH-102138	<a href="#">Polymerengineering II</a>			Liebig
ST 2026	76-T-MACH-102138	<a href="#">Polymerengineering II</a>			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

**6.146 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2141853	<a href="#">Polymers in MEMS A: Chemistry, Synthesis and Applications</a>	2 SWS	/ 	Worgull
Exams					
WT 25/26	76-T-MACH-102192	<a href="#">Polymers in MEMS A: Chemistry, Synthesis and Applications</a>			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

**6.147 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2141854	<a href="#">Polymers in MEMS B: Physics, Microstructuring and Applications</a>	2 SWS	Lecture / 	Worgull
Exams					
WT 25/26	76-T-MACH-102191	<a href="#">Polymers in MEMS B: Physics, Microstructuring and Applications</a>			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****6.148 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2142855	<a href="#">Polymers in MEMS C - Biopolymers and Bioplastics</a>	2 SWS	/ 	Worgull
Exams					
WT 25/26	76-T-MACH-102200	<a href="#">Polymers in MEMS C: Biopolymers and Bioplastics</a>			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](mailto: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](mailto:matthias.worgull@kit.edu)). Eine Voranmeldung ist nicht notwendig.

**Literature**

Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.

**T****6.149 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-103715 - Technical Specialisation](#)

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

Exams			
WT 25/26	76-T-MACH-105216	<a href="#">Powertrain Systems Technology B: Stationary Machinery</a>	Ott
ST 2026	76-T-MACH-105216	<a href="#">Drive Systems Engineering B: Stationary Machinery</a>	Albers, Ott

**Assessment**

written examination: 60 min duration

**Prerequisites**

None

**Additional Information**

The course is offered in German.

**Workload**

120 hours

**T****6.150 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-103738 - Structural Materials](#)

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

## 6.151 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-103740 - Materials Processing](#)

Type	Credits	Grading	Version
Coursework (practical)	1 CP	pass/fail	1

Courses					
ST 2026	2241021	<a href="#">Practical in Additive Manufacturing for Process Engineering</a>	1 SWS	Practical course / 	Klahn
Exams					
ST 2026	7241021	<a href="#">Practical in Additive Manufacturing for Process Engineering</a>			Klahn

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

### Assessment

Learning control is an ungraded completed coursework: Lab, 8 experiments.

T

## 6.152 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2143875	<a href="#">Introduction to Microsystem Technology - Practical Course</a>	2 SWS	Practical course /	Last
ST 2026	2143875	<a href="#">Introduction to Microsystem Technology - Practical Course</a>	2 SWS	Practical course /	Last
Exams					
WT 25/26	76-T-MACH-102164	<a href="#">Practical Training in Basics of Microsystem Technology</a>			Last
ST 2026	76-T-MACH-102164	<a href="#">Practical Training in Basics of Microsystem Technology</a>			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

2143875, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Practical course (P)  
On-Site**

### 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'

**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 "Laborpraktikum", 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


## 6.153 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-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2193010	<a href="#">Basic principles of powder metallurgical and ceramic processing</a>	2 SWS	Lecture / 	Schell
Exams					
WT 25/26	76-T-MACH-102111	<a href="#">Principles of Ceramic and Powder Metallurgy Processing</a>			Schell
ST 2026	76-T-MACH-102111	<a href="#">Principles of Ceramic and Powder Metallurgy Processing</a>			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: Ceramic 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. Thümmel, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T


**6.154 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2149670	<a href="#">Product- and Production-Concepts for modern Automobiles</a>	2 SWS	Lecture / 	Steegmüller, Kienzle
Exams					
WT 25/26	76-T-MACH-110318	<a href="#">Product- and Production-Concepts for modern Automobiles</a>			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 Lightweight 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

**6.155 Module component: Product Lifecycle Management [T-MACH-105147]****Coordinators:** Prof. Dr.-Ing. Jivka Ovtcharova**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Exams				
WT 25/26	76-T-MACH-105147	<a href="#">Product Lifecycle Management</a>	Ovtcharova, Meyer, Rönnau	

**Assessment**

Written examination 90 min.

**Prerequisites**


None

**Workload**

120 hours

**T****6.156 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-103740 - Materials Processing](#)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	3

Courses					
ST 2026	2150704	<a href="#">Project Course Additive Manufacturing: Design Optimization and Production of Metallic Components</a>	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**2150704, SS 2026, 3 SWS, Language: German, [Open in study portal](#)**Practical course (P)  
On-Site**

**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

**6.157 Module component: Quality Management [T-MACH-102107]****Coordinators:** Prof. Dr.-Ing. Gisela Lanza**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2149667	<a href="#">Quality Management</a>	2 SWS	Lecture / 	Lanza, Benfer
Exams					
WT 25/26	76-T-MACH-102107	<a href="#">Quality Management</a>	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 definition
- 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

**6.158 Module component: Rail System Technology [T-MACH-106424]****Coordinators:** Prof. Dr.-Ing. Martin Cichon**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103715 - Technical Specialisation](#)

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	5

Courses					
WT 25/26	2115919	<a href="#">Rail System Technology</a>	2 SWS	Lecture /	Cichon
ST 2026	2115919	<a href="#">Rail System Technology</a>	2 SWS	Lecture /	Cichon
Exams					
WT 25/26	76-T-MACH-106424	<a href="#">Rail System Technology</a>			Cichon
ST 2026	76-T-MACH-106424	<a href="#">Rail System Technology</a>			Cichon

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

**Assessment**

written 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

**6.159 Module component: Rail Vehicle Technology [T-MACH-105353]**

**Coordinators:** Prof. Dr.-Ing. Martin Cichon  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103715 - Technical Specialisation](#)

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each term	5

Courses					
WT 25/26	2115996	<a href="#">Rail Vehicle Technology</a>	2 SWS	Lecture /	Cichon
ST 2026	2115996	<a href="#">Rail Vehicle Technology</a>	2 SWS	Lecture /	Cichon
Exams					
WT 25/26	76-T-MACH-105353	<a href="#">Rail Vehicle Technology</a>			Cichon
ST 2026	76-T-MACH-105353	<a href="#">Rail Vehicle Technology</a>			Cichon

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

**Assessment**

written 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: principles, 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: principles, 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

**6.160 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

**6.161 Module component: Robotics I - Introduction to Robotics [T-INFO-108014]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2424152	<a href="#">Robotics I - Introduction to Robotics</a>	4 SWS	Lecture / 🗎	Asfour, Mombaur
Exams					
WT 25/26	7500106	<a href="#">Robotics I - Introduction to Robotics</a>			Asfour
ST 2026	7500218	<a href="#">Robotics I - Introduction to Robotics</a>			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



**6.162 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2181738	<a href="#">Scientific computing for Engineers</a>	2 SWS	Lecture / 	Weygand, Gumbsch
WT 25/26	2181739	<a href="#">Exercises for Scientific Computing for Engineers</a>	2 SWS	Practice / 	Weygand
Exams					
WT 25/26	76-T-MACH-100532	<a href="#">Scientific Computing for Engineers</a>	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++
  - \* programm 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. Breyman, 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

**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

## 6.163 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-103721 - 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

## 6.164 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-103721 - 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

## 6.165 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Graded [T-MACH-113324]

**Coordinators:** Prof. Dr. Astrid Pundt

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103721 - 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 Zentrum für Angewandte Kulturwissenschaften (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

## 6.166 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-103721 - 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

## 6.167 Module component: Self-Booking-MSc-HOC-SPZ-FORUM-Non-Graded [T-MACH-113323]

**Coordinators:** Prof. Dr. Astrid Pundt

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103721 - 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 Zentrum für Angewandte Kulturwissenschaften (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

## 6.168 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-103721 - 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



**6.169 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-103739 - Computational Materials Science](#)

Type	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	3

Courses					
WT 25/26	2183717	<a href="#">Seminar "Materials Modelling"</a>	4 SWS	Seminar / 	Gumbsch, Nestler, Böhlke, August, Schulz, Prahs, Weygand
ST 2026	2183717	<a href="#">Seminar "Materials Modeling"</a>	4 SWS	Seminar / 	Nestler, Gumbsch, Böhlke, Weygand
Exams					
WT 25/26	76-T-MACH-107660	<a href="#">Seminar "Materials Modelling"</a>			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 knowledge 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 knowledge in mathematics, physics and materials science recommended

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 knowledge in mathematics, physics and materials science recommended

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


**6.170 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-103739 - Computational Materials Science](#)

Type	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	1

Courses					
WT 25/26	2183717	<a href="#">Seminar "Materials Modelling"</a>	4 SWS	Seminar / 	Gumbsch, Nestler, Böhlke, August, Schulz, Prahs, Weygand
Exams					
WT 25/26	76-T-MACH-113814	<a href="#">Seminar Materials Simulation</a>			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 knowledge 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 knowledge in mathematics, physics and materials science recommended

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****6.171 Module component: Sensor Systems [T-ETIT-100709]**

**Coordinators:** Dr. Wolfgang Menesklou  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** [M-MACH-103741 - Functional Materials](#)


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





T

**6.172 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2304231	<a href="#">Sensors</a>	2 SWS	Lecture / 	Schröder
Exams					
WT 25/26	7304231	<a href="#">Sensors</a>			Menesklou
ST 2026	7304231	<a href="#">Sensors</a>			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

**6.173 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-103739 - Computational Materials Science](#)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

**Prerequisites**  
none





T

**6.174 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-103740 - Materials Processing](#)

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

Courses					
ST 2026	2114107	<a href="#">Simulation of the Process Chain of Continuously Fiber Reinforced Composite Structures</a>	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.

T

**6.175 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2312680	<a href="#">Single-Photon Detectors</a>	2 SWS	Lecture / 	Ilin
WT 25/26	2312694	<a href="#">Tutorial for 2312680 Single-Photon Detectors</a>	1 SWS	Practice / 	Ilin
Exams					
WT 25/26	7312680	<a href="#">Single-Photon Detectors</a>			Ilin
ST 2026	7312680	<a href="#">Single-Photon Detectors</a>			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



**6.176 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2313745	<a href="#">Solar Energy</a>	3 SWS	Lecture / 	Richards, Paetzold
WT 25/26	2313750	<a href="#">Tutorial 2313745 Solar Energy</a>	1 SWS	Practice / 	Richards, Paetzold
Exams					
WT 25/26	7313745	<a href="#">Solar Energy</a>			Richards, Paetzold
ST 2026	7313745	<a href="#">Solar Energy</a>			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

**6.177 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-103715 - Technical Specialisation](#)

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	5

Courses					
WT 25/26	2189400	<a href="#">Solar Thermal Energy Systems</a>	2 SWS	Lecture / 	Dagan
Exams					
WT 25/26	76-T-MACH-106493	<a href="#">Solar Thermal Energy Systems</a>			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


## 6.178 Module component: Solid State Reactions and Kinetics of Phase [T-MACH-107667]





**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr  
Dr. Christopher Stihl

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103711 - Kinetics](#)

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

Courses					
WT 25/26	2193003	<a href="#">Solid State Reactions and Kinetics of Phase Transformations</a>	2 SWS	Lecture / 	Gorr, Stihl
Exams					
WT 25/26	76-T-MACH-107667	<a href="#">Solid State Reactions and Kinetics of Phase</a>			Gorr, Stihl

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

### Assessment

oral examination (about 30 min)

### Prerequisites

The successful participation in Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion is the condition for the admittance to the oral exam in Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion.

T-MACH-110926 – Exercises for Solid State Reactions and Kinetics of Phase Transformations has not been started.

T-MACH-110927 – Solid State Reactions and Kinetics of Phase has not been started.

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) must have been passed.
2. The module component [T-MACH-110927 - Solid State Reactions and Kinetics of Phase Transformations](#) must not have been started.
3. The module component [T-MACH-110926 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) must not have been started.

### Recommendations

Basic course in materials science and engineering

Basic course in mathematics

physical chemistry

### Additional Information

The course is offered in German.

### Workload

120 hours

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

V

## Solid State Reactions and Kinetics of Phase Transformations

2193003, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Oral examination (about 30 min)

Teaching Content:

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

Recommendations:

knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Basic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

**Literature**

1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.
4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.

T


## 6.179 Module component: Solid State Reactions and Kinetics of Phase Transformations [T-MACH-110927]





**Coordinators:** Prof. Dr.-Ing. Bronislava Gorr

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103711 - Kinetics](#)

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

Courses					
ST 2026	2194722	<a href="#">Solid State Reactions and Kinetics of Phase Transformations, Corrosion</a>	2 SWS	Lecture / 	Gorr, Tang
Exams					
ST 2026	76-T-MACH-110927	<a href="#">Solid State Reactions and Kinetics of Phase Transformations, Corrosion</a>			Gorr

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

### Assessment

oral examination (about 30 min)

### Prerequisites

The successful participation in Exercises for Solid State Reactions and Kinetics of Phase Transformations is the condition for the admittance to the oral exam in Solid State Reactions and Kinetics of Phase.

T-MACH-107632 – Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion has not been started.

T-MACH-107667 – Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion has not been started.

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component [T-MACH-107667 - Solid State Reactions and Kinetics of Phase Transformations, Corrosion](#) must not have been started.
2. The module component [T-MACH-110926 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) must have been passed.
3. The module component [T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations](#) must not have been started.

### Recommendations

Basic course in materials science and engineering

Basic course in mathematics

physical chemistry

### Additional Information

The course is offered in English.

### Workload

120 hours

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

V

### Solid State Reactions and Kinetics of Phase Transformations, Corrosion

2194722, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Oral examination (about 30 min)

Teaching Content:

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

Recommendations:

knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Basic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

**Organizational issues**

The lecture will take place in building 10.91, room 228.

**Literature**


1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.
4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.





T

**6.180 Module component: Solid-State Optics, without Exercises [T-PHYS-104773]**

**Coordinators:** PD Dr. Michael Hetterich  
**Organisation:** KIT Department of Physics  
**Part of:** [M-MACH-103741 - Functional Materials](#)

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

Courses					
WT 25/26	4020011	<a href="#">Solid-State-Optics</a>	4 SWS	Lecture / 	Hetterich
Exams					
WT 25/26	7800104	<a href="#">Solid-State Optics, without Exercises</a>			Hetterich

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

**Prerequisites**

none

T

**6.181 Module component: Structural and Phase Analysis [T-MACH-102170]****Coordinators:** Dr.-Ing. Susanne Wagner**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Exams			
WT 25/26	76-T-MACH-102170	<a href="#">Structural and Phase Analysis</a>	Wagner

**Assessment**

Oral examination

**Prerequisites**


none

T

**6.182 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2312698	<a href="#">Superconducting Magnet Technology</a>	3 SWS	Lecture / Practice / 	Arndt
Exams					
WT 25/26	7300031	<a href="#">Superconducting Magnet Technology</a>			Arndt
ST 2026	7300001	<a href="#">Superconducting Magnet Technology</a>			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


**6.183 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2312696	<a href="#">Superconducting Materials Part II</a>	2 SWS	Practical course / 	Holzapfel, Hänisch
Exams					
WT 25/26	7312696	<a href="#">Superconducting Materials</a>			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 be 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 recommended to pass the lecture (part I) before the lab (part II).

T


**6.184 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2312717	<a href="#">Superconducting Materials Part I</a>	2 SWS	Lecture / 	Holzapfel, Hänisch
Exams					
WT 25/26	7312696	<a href="#">Superconducting Materials</a>			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 recommended to pass the lecture (part I) before the lab (part II).

T

**6.185 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-103741 - Functional Materials](#)

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

Courses					
ST 2026	2312671	<a href="#">Superconducting Nanowire Detectors</a>	2 SWS	Lecture / 	Ilin
ST 2026	2312673	<a href="#">Practice to 2312671 Superconducting Nanowire Detectors</a>	1 SWS	Practice / 	Ilin
Exams					
ST 2026	7312671	<a href="#">Superconducting Nanowire Detectors</a>			Ilin

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

Oral Exam (approx. 20 min.)


**Prerequisites**





none

T

**6.186 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	2314011	<a href="#">Superconducting Power Systems</a>	3 SWS	Lecture / Practice / 	Noe
Exams					
WT 25/26	7300034	<a href="#">Superconducting Power Systems</a>			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

**6.187 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-103741 - Functional Materials](#)

<b>Type</b> Written examination	<b>Credits</b> 6 CP	<b>Grading</b> graded	<b>Term offered</b> Each winter term	<b>Expansion</b> 1 semesters	<b>Version</b> 4
------------------------------------	------------------------	--------------------------	---	---------------------------------	---------------------

Courses					
WT 25/26	2312708	<a href="#">Superconductivity for Engineers</a>	3 SWS	Lecture / 🎧	Kempf, Holzapfel
WT 25/26	2312709	<a href="#">Exercise for 2312708 Superconductivity for Engineers</a>	1 SWS	Practice / 🎧	Hänisch, Arldt
Exams					
WT 25/26	7312708	<a href="#">Superconductivity for Engineers</a>			Kempf
ST 2026	7312691	<a href="#">Superconductivity for Engineers</a>			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 be started.

T-ETIT-114730 - Superconducting Materials Lab must not be 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

**6.188 Module component: Superhard Thin Film Materials [T-MACH-102103]****Coordinators:** Prof. Sven Ulrich**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2177618	<a href="#">Superhard Thin Film Materials</a>	2 SWS	Lecture / 	Ulrich
Exams					
WT 25/26	76-T-MACH-102103	<a href="#">Superhard Thin Film Materials</a>			Ulrich

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

oral examination (ca. 30 Minuten)

**Prerequisites**

Either "Superharte Dünnschichtmaterialien" or "Superhard Thin Film Materials" can be chosen within the Focal Course.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-111257 - Superhard Thin Film Materials](#) 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

**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 [svен.ulrich@kit.edu](mailto:svен.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

**6.189 Module component: Superhard Thin Film Materials [T-MACH-111257]****Coordinators:** Prof. Sven Ulrich**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
ST 2026	2194729	<a href="#">Superhard Thin Film Materials</a>	2 SWS	Lecture / 	Ulrich
Exams					
WT 25/26	76-T-MACH-111257	<a href="#">Superhard Thin Film Materials</a>			Ulrich

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

oral examination (ca. 30 Minuten)

**Prerequisites**

Either "Superharte Dünnschichtmaterialien" or "Superhard Thin Film Materials" can be chosen within the Focal Course.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-MACH-102103 - Superhard Thin Film Materials](#) must not have been started.

**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](mailto: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

**6.190 Module component: Sustainable Vehicle Drivetrains [T-MACH-111578]**

**Coordinators:** Dr.-Ing. Olaf Toedter  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2133132	<a href="#">Sustainable Vehicle Drivetrains</a>	3 SWS	Lecture / 	Toedter
Exams					
WT 25/26	76-T-MACH-105655	<a href="#">Sustainable Vehicle Drivetrains</a>			Toedter

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

**Assessment**

oral exam (approx. 20 minutes)

**Prerequisites**

none

**Additional Information**

Starting in winter term 25/26, the course consists of a lecture (2h / week) and a tutorial (1 h / week).

This course is offered in German.

**Workload**

120 hours


T





**6.191 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-103738 - Structural Materials](#)

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

Courses					
ST 2026	2174579	<a href="#">Technology of steel components</a>	2 SWS	Lecture / 	Schulze
Exams					
WT 25/26	76-T-MACH-105362	<a href="#">Technology of Steel Components</a>			Schulze
ST 2026	76-T-MACH-105362	<a href="#">Technology of Steel Components</a>			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



**6.192 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-103739 - Computational Materials Science](#)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2026	4023151	<a href="#">The ABC of DFT</a>	2 SWS	Lecture / 	Krstic, Wenzel, Holzer
ST 2026	4023152	<a href="#">Exercises to The ABC of DFT</a>	1 SWS	Practice / 	Wenzel, Holzer

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

T



**6.193 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-103741 - Functional Materials](#)

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

Courses					
WT 25/26	4023011	<a href="#">Theoretical Quantum Optics</a>	2 SWS	Lecture / 	Rockstuhl
WT 25/26	4023012	<a href="#">Exercises to Theoretical Quantum Optics</a>	1 SWS	Practice / 	Rockstuhl, Poleva, Ustimenko
Exams					
WT 25/26	7800096	<a href="#">Theoretical Quantum Optics</a>	Rockstuhl, Metelmann		

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

## T

**6.194 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-103715 - Technical Specialisation](#)

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	3

Exams			
WT 25/26	76-T-MACH-105363	<a href="#">Thermal Turbomachines I</a>	Bauer
WT 25/26	76-T-MACH-105363-Wdh	<a href="#">Thermal Turbomachines I (for repeaters)</a>	Bauer
ST 2026	76-T-MACH-105363	<a href="#">Thermal Turbomachines I</a>	Bauer
ST 2026	76-T-Mach-105363-Wdh	<a href="#">Thermal Turbomachines I (for repeater)</a>	Bauer

**Assessment**

oral exam, duration 30 min.

**Prerequisites**

none

**Workload**

180 hours

## T

**6.195 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-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2170477	<a href="#">Tutorial - Thermal Turbomachines II</a>	2 SWS	Practice /	Bauer, Mitarbeiter
ST 2026	2170553	<a href="#">Thermal Turbomachines II</a>	3 SWS	Lecture /	Bauer
Exams					
WT 25/26	76-T-MACH-105364	<a href="#">Thermal Turbomachines II</a>			Bauer
WT 25/26	76-T-MACH-105364-Wdh	<a href="#">Thermal Turbomachines II (for repeaters)</a>			Bauer
ST 2026	76-T-MACH-105364	<a href="#">Thermal Turbomachines II</a>			Bauer
ST 2026	76-T-Mach-105364-Wdh	<a href="#">Thermal Turbomachines II (for repeaters)</a>			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 describe and analyse not only the individual components but also entire assemblies. The students can assess 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



## 6.196 Module component: Thermophysics of Advanced Materials [T-MACH-111459]





**Coordinators:** Dr. Dmitry Sergeev

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2193051	<a href="#">Thermophysics of Advanced Materials</a>	2 SWS	Lecture / 	Sergeev
ST 2026	2193051	<a href="#">Thermophysics of Advanced Materials</a>	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



## 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

**6.197 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-103738 - Structural Materials](#)

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	<a href="#">Thin Films – Structure, Thermodynamics, Applications in Energy Technologies</a>	Wagner

**Assessment**

oral exam, about 25 minutes

**Prerequisites**

none

**Additional Information**

The course is offered in English.

**Workload**

120 hours

## T


**6.198 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-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2181114	<a href="#">Tribology</a>	5 SWS	Lecture / Practice / 	Dienwiebel, Scherge
Exams					
WT 25/26	76-T-MACH-114853	<a href="#">Tribology (new, MACH, PO 2025)</a>			Dienwiebel
ST 2026	76-T-MACH-114853	<a href="#">Tribology (new, MACH, PO 2025)</a>			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 - Exercises - Tribology](#) must have been passed.

**Recommendations**

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

## 6.199 Module component: Turbo Jet Engines [T-MACH-105366]

**Coordinators:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
 Institute of Thermal Turbomachinery  
**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
ST 2026	2170478	<a href="#">Turbo Jet Engines</a>	2 SWS	Lecture /	Bauer
ST 2026	2170479	<a href="#">Exkursion (1tägig) zu Turbinen-Luftstrahl-Triebwerke</a>	1 SWS	Excursion /	Bauer
Exams					
WT 25/26	76-T-MACH-105366	<a href="#">Turbo Jet Engines</a>			Bauer
ST 2026	76-T-MACH-105366	<a href="#">Turbo Jet Engines</a>			Bauer

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

**Assessment**

oral exam, duration: approx. 30 min.

**Prerequisites**

Good basic knowledge of fluid mechanics and thermodynamics.

**Additional Information**

The course is offered in German.

**Workload**

120 hours

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

## V

**Turbo Jet Engines**

2170478, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

Introduction to jet engines and their components

Demands on engines and propulsive efficiency

Thermodynamic and Fluid mechanics fundamentals and design calculations

Components of air breathing engines

Jet engine design and development process

Engine and component design

Current developments in the jet engines industry

The students have the ability to:

- compare the design concepts of modern jet engines
- analyse the operation of modern jet engines
- apply the thermodynamic and fluidmechanic basics of jet engines
- choose the main components intake, compressor, combustor, turbine and thrust nozzle based on given criteria
- comment on different methods for the reduction of pollutant emissions, noise and fuel consumption

regular attendance:21 h

self-study: 99 h

Exam: oral

Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

**Literature**

Skripte der Vorlesung Maschinen und Prozesse (Deutsch/Englisch) (in CAS)

Hagen, H.: Fluggasturbinen und ihre Leistungen, G. Braun Verlag, 1982

Hünnecke, K.: Flugtriebwerke, ihre Technik und Funktion, Motorbuch Verlag, 1993

Saravanamuttoo, H.; Rogers, G.; Cohen, H.: Gas Turbine Theory, 5th Ed., 04/2001

Rolls-Royce: The Jet Engine, ISBN:0902121235, 2005

T


**6.200 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2161147	<a href="#">Tutorial Computational Elasticity</a>	2 SWS	Practice / 	Hille, Speichinger, Langhoff
Exams					
WT 25/26	76-T-MACH-114529	<a href="#">Tutorial Computational Elasticity</a>	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:*

	<b>Tutorial Computational Elasticity</b> 2161147, WS 25/26, 2 SWS, Language: English, <a href="#">Open in study portal</a>	<b>Practice (Ü) On-Site</b>
---	---	---------------------------------

**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


**6.201 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162297	<a href="#">Tutorial Computational Inelasticity</a>	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 Inelasticity"

**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


## 6.202 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-103739 - Computational Materials Science](#)

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

Courses					
WT 25/26	2162257	<a href="#">Tutorial Introduction to the Finite Element Method</a>	1 SWS	Practice / 	Lauff, Klein, Langhoff, Böhlke
Exams					
WT 25/26	76-T-MACH-110330	<a href="#">Tutorial Introduction to the Finite Element Method</a>			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

**6.203 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-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162281	<a href="#">Tutorial Mathematical Methods in Micromechanics</a>	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


## 6.204 Module component: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]





**Coordinators:** Prof. Dr.-Ing. Thomas Böhlke

**Organisation:**

**Part of:** [M-MACH-103739 - Computational Materials Science](#)

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

Courses					
ST 2026	2162345	<a href="#">Tutorial in Nonlinear Continuum Mechanics</a>	2 SWS	Practice / 	Hille, Klein, Böhlke
Exams					
WT 25/26	76-T-MACH-111027	<a href="#">Tutorial Nonlinear Continuum Mechanics</a>	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

**6.205 Module component: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]**

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

Lightweight Design

**Part of:** [M-MACH-103738 - Structural Materials](#)

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

Courses					
WT 25/26	2113102	<a href="#">Vehicle Lightweight design – Strategies, Concepts, Materials</a>	2 SWS	Lecture / 	Henning
Exams					
WT 25/26	76-T-MACH-105237	<a href="#">Vehicle Lightweight Design - Strategies, Concepts, Materials</a>			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

Metallic 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

**6.206 Module component: Vibration Theory [T-MACH-105290]****Coordinators:** Prof. Dr.-Ing. Alexander Fidlin**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2161212	<a href="#">Vibration Theory</a>	2 SWS	Lecture / 🗎	Ströhle, Genda
WT 25/26	2161213	<a href="#">Vibration Theory (Tutorial)</a>	2 SWS	Practice / 🗎	Ströhle, Genda
Exams					
WT 25/26	76-T-MACH-105290	<a href="#">Vibration Theory</a>			Fidlin, Ströhle, Genda

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

**Assessment**

written exam, 180 min.

**Prerequisites**

Engineering Mechanics III comparable basic knowledge of dynamics

**Additional Information**

The course is offered in German.

**Workload**

120 hours

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

V

**Vibration Theory**2161212, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)  
On-Site****Content**

Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

**Literature**

Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd. 1 und Bd. 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

V

**Vibration Theory (Tutorial)**2161213, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Practice (Ü)  
On-Site**


**Content**





Exercises related to the lecture

T

**6.207 Module component: Welding Technology [T-MACH-105170]****Coordinators:** Dr.-Ing. Majid Farajian**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-103740 - Materials Processing](#)

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

Courses					
WT 25/26	2173571	<a href="#">Welding Technology</a>	2 SWS	Block / 	Farajian
Exams					
WT 25/26	76-T-MACH-105170	<a href="#">Welding Technology</a>			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.

T

**6.208 Module component: Windpower [T-MACH-105234]**

**Coordinators:** Norbert Lewald  
**Organisation:** KIT Department of Mechanical Engineering  
 Institute of Thermal Turbomachinery  
**Part of:** [M-MACH-103715 - Technical Specialisation](#)

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

Courses					
WT 25/26	2157381	<a href="#">Windpower</a>	2 SWS	Lecture / 	Lewald
Exams					
WT 25/26	76-T-MACH-105234	<a href="#">Windpower</a>			Lewald
ST 2026	76-T-MACH-105234	<a href="#">Windpower</a>			Lewald

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

**Assessment**

Written exam.

Duration: 80 min

**Prerequisites**

none

**Additional Information**

The course is offered in German.

**Workload**

120 hours

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

V

**Windpower**

2157381, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
**On-Site**



## **Studies and Examination Regulations of Karlsruhe Institute of Technology (KIT) for the Master's Program of Materials Science and Engineering**

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

This is a condensed translation of the following German documents:

- Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik, 27. Juni 2017
- Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik, 26. Februar 2019
- Berichtigung der Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik, 28. Februar 2019
- Zweite Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik, 24. Februar 2020
- Vierte Satzung zur Änderung der Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Materialwissenschaft und Werkstofftechnik, 21. Oktober 2021

**Studies and Examination Regulations of Karlsruhe Institute of Technology  
(KIT) for the Master's Program of Materials Science and Engineering**

dated June 26, 2017

Pursuant to Article 10, par. 2, clause 5 and Article 20, par. 2, clause 1 of the Act on Karlsruhe Institute of Technology (KIT Act – KITG), as amended on July 14, 2009 (bulletin, p. 317 f.), last amended by Article 4 of the Act on the Change of State University Tuition Fees and Other Acts of May 09, 2017 (bulletin pp. 245, 250), and Article 32, par. 3, clause 1 of the Act of Baden-Württemberg on Universities and Colleges (Landeshochschulgesetz – LHG) of January 01, 2005 (bulletin, p. 1 f.), last amended by the Act on the Change of State University Tuition Fees and Other Acts of May 09, 2017 (bulletin pp. 245, 250), the Senate of KIT adopted the following Studies and Examination Regulations for the Master's Program of Materials Science and Engineering on June 19, 2017.

The President expressed his approval of the last amendment according to Article 20, par. 2, KITG in conjunction with Article 32, par. 3, clause 1, LHG on October 20, 2021.

## **Contents**

### **I. General Provisions**

- Article 1 – Scope
- Article 2 – Objective of Studies, Academic Degree
- Article 3 – Regular Period of Studies, Organization of Studies, Credits
- Article 4 – Module Examinations, Coursework and Examinations
- Article 5 – Registration for and Admission to Module Examinations and Courses
- Article 6 – Execution of Controls of Success
- Article 6 a – Controls of Success by a Multiple Choice Test
- Article 6 b – Computer-based Controls of Success
- Article 7 – Evaluation of Coursework and Examinations
- Article 8 – Repetition of Examinations, Ultimate Failure
- Article 9 – Loss of the Entitlement to an Examination
- Article 10 – Deregistration, Absence, Withdrawal
- Article 11 – Deception, Breach of Regulations
- Article 12 – Maternity Protection, Parental Leave, Assumption of Family Obligations
- Article 13 – Students with a Disability or Chronic Disease
- Article 14 – Master’s Thesis Module
- Article 14 a – Internship
- Article 15 – Additional Achievements
- Article 15a – Transferable Skills
- Article 16 – Examination Committee
- Article 17 – Examiners and Associates
- Article 18 – Recognition of Coursework and Examinations as well as of Study Periods

### **II. Master’s Examination**

- Article 19 – Scope and Type of the Master’s Examination
- Article 19a – Certificates of Achievements for the Master’s Examination
- Article 20 – Passing of the Master’s Examination, Calculation of the Total Grade
- Article 21 – Master’s Transcript, Master’s Certificate, Diploma Supplement, and Transcript of Records

### **III. Final Provisions**

- Article 22 – Certificate of Examination Achievements
- Article 23 – Deprivation of the Master’s Degree
- Article 24 – Inspection of Examination Files
- Article 25 – Entry into Force, Transition Regulations

## **Preamble**

Within the framework of the implementation of the Bologna process for establishment of a European higher education area, it is the declared objective of KIT that higher education at KIT should be completed by a master's degree. KIT therefore understands the consecutive bachelor's and master's programs offered to represent an integrated concept with a consecutive curriculum.

## **I. General Provisions**

### **Article 1 – Scope**

The present master's examination regulations shall cover the course of studies, examinations, and graduation in the Master's Program of Materials Science and Engineering at KIT.

### **Article 2 – Objective of Studies, Academic Degree**

(1) During the consecutive master's program, scientific qualifications acquired in the course of the bachelor's program shall be further enhanced, expanded, extended, or complemented. Having completed the studies, the student shall be able to independently apply scientific findings and methods and to evaluate their significance and applicability to the solution of complex scientific and social problems.

(2) Upon successful completion of the master's examination, the academic degree of "Master of Science" (abbreviated by "M.Sc.") shall be conferred for the Master's Program of Materials Science and Engineering.

### **Article 3 – Regular Period of Studies, Organization of Studies, Credits**

(1) The regular period of studies shall be four semesters.

(2) The curriculum of the program is divided into subjects, the subjects into modules, and the modules are divided into courses. The subjects and their scopes are defined in Article 19. Details are outlined in the module manual.

(3) The work expenditure envisaged for passing courses and modules is expressed in credits. The criteria for assigning credits correspond to the European Credit Transfer System (ECTS). One credit corresponds to a work expenditure of about 30 hours. As a rule, the credits shall be distributed equally over the semesters.

(4) The coursework and examinations required for the successful completion of the studies are measured in credits and amount to a total of 120 credits.

(5) The courses may be offered in the German and English languages.

#### **Article 4 – Module Examinations, Coursework and Examinations**

(1) The master's examination shall consist of module examinations. Module examinations shall consist of one or several controls of success. Controls of success shall consist of coursework and examinations.

(2) Examinations are:

1. Written examinations,
2. oral examinations, or
3. examinations of another type.

(3) Coursework shall be written, oral, or practical work that is usually accomplished by students parallel to the courses. The master's examination must not be completed by a coursework.

(4) At least 70% of the module examinations shall be graded.

(5) In case of complementary contents, module examinations of several modules may be replaced by a module-overlapping examination (par. 2, nos. 1-3).

### **Article 5 – Registration for and Admission to Module Examinations and Courses**

(1) To participate in module examinations, students shall register online on the Students Portal for the corresponding controls of success. In exceptional cases, registration can be made in writing with the Students Office or another institution authorized by the latter. For controls of success, registration deadlines may be specified by the examiners. Registration of the master's thesis is outlined in the module manual.

(2) For admission to an examination in a certain module of choice, students, prior to the first examination in this module, shall submit together with their registration for the examination a binding declaration relating to their choice of the module and its assignment to a subject. At the request of the student to the examination committee, the choice or assignment can be changed later on.

(3) Admission to a control of success shall be granted to students, who

1. are enrolled in the Master's Program of Materials Science and Engineering at KIT, with the admission of students on leave being limited to examinations, and to students, who
2. can prove that they meet the requirements for admission to a control of success outlined in the module manual and
3. can prove that their entitlement to an examination in the Master's Program of Materials Science and Engineering has not been lost, and
4. meet the requirement outlined in Article 19a.

(4) According to Article 30, par. 5, LHG, admission to individual mandatory courses may be restricted. The examiner shall decide on the selection of students, who have registered in due time before the deadline given by the examiner, taking into account the study progress made by these students and taking into consideration Article 13, par. 1, clauses 1 and 2, if the surplus of registrations cannot be reduced by other or additional courses. In the case of identical study progress, further criteria shall be specified by the KIT Departments. The result shall be announced to the students in due time.

(5) Admission shall be refused, if the conditions outlined in pars. 3 and 4 are not fulfilled. Admission may be refused, if the corresponding control of success was already passed in a KIT bachelor's program that was required for admission to this Master's Program. This shall not apply to premature master's examinations. Admission to these shall be approved explicitly according to clause 1.

#### **Article 6 – Execution of Controls of Success**

(1) Controls of success shall be performed parallel to the studies, usually while imparting the contents of the individual modules or shortly afterwards.

(2) The type of control of success (Article 4, par. 2, nos. 1 - 3, par. 3) shall be specified by the examiner of the respective course depending on the contents of the course and teaching objectives of the module. The type of controls of success, their frequency, sequence, weighting, and the determination of the module grade, if applicable, shall be announced in the module manual six weeks prior to the start of the lecturing period at the latest. The examiner and student may agree on a change of the type of examination and the examination language later on. In the former case, Article 4, par. 4 shall be observed. When organizing examinations, the needs of students with a disability or chronic disease shall be considered according to Article 13, par. 1. Article 13, par. 1, clauses 3 and 4 shall apply accordingly.

(3) In case of an unreasonably high examination expenditure, a written examination may also be passed orally or an oral examination may also be passed in writing. This modification shall be announced six weeks prior to the examination at the latest.

(4) In case of courses in the English language (Article 3, par. 5), the corresponding controls of success shall be executed in this language. Article 6, par. 2 shall apply accordingly.

(5) *Written examinations* (Article 4, par. 2, no. 1) shall usually be evaluated by an examiner according to Article 18, par. 2 or par. 3. If an evaluation is made by several examiners, the grade shall be the arithmetic mean of the individual evaluations. If the arithmetic mean does not correspond to any of the grade levels defined in Article 7,

par. 2, clause 2, the grade shall be rounded to the next higher or lower grade level. In case of equal distance to the next higher and lower levels, the grade shall be rounded to the next higher grade level. The evaluation procedure shall not exceed six weeks. Written examinations shall last at least 60 and not more than 300 minutes.

(6) *Oral examinations* (Article 4, par. 2, no. 2) shall be performed and evaluated as group or individual examinations by several examiners (examining board) or by one examiner in the presence of an associate. Prior to determining the grade, the examiner shall consult the other examiners of the examining board. Oral examinations shall usually last at least 15 minutes and not more than 60 minutes per student.

Major details and results of the *oral examination* shall be documented in the minutes. The result of the examination shall be announced to the student directly after the oral examination.

Students, who intend to take the same examination in a later semester, shall be admitted to oral examinations as an audience depending on the space available and upon approval of the examinee. They shall not be admitted to the consultation of the examining board and announcement of the examination results.

(7) For *examinations of another type* (Article 4, par. 2, no. 3), appropriate deadlines and submission dates shall be specified. Proper description of the task and adequate documentation shall ensure that the examination passed can be credited to the student. Major details and results of the control of success shall be recorded in the minutes.

During *oral examinations of another type*, an associate shall be present in addition to the examiner, who shall also sign the minutes together with the examiner.

*Theses or papers to be written for an examination of another type* shall be provided with the following declaration: "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." (I herewith declare that the present thesis/paper

is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications). If the thesis/paper does not contain this declaration, it shall not be accepted. Major details and results of such a control of success shall be recorded in the minutes.

#### **Article 6 a – Controls of Success by a Multiple Choice Test**

It is outlined in the module manual whether and to what an extent controls of success can be made by a *multiple choice test*.

#### **Article 6 b – Computer-based Controls of Success**

(1) Controls of success can be carried out in a computer-based way. In this case, the reply or solution of the student is transmitted electronically and, if possible, evaluated automatically. The examination contents shall be generated by an examiner.

(2) Prior to the computer-based control of success, the examiner shall ensure that the electronic data can be identified clearly and allocated unambiguously and permanently to the student. A trouble-free computer-based control of success shall be guaranteed by the corresponding technical support. In particular, the control of success shall be carried out in the presence of a competent person. All examination tasks must be available for work by the examinee during the entire examination period.

(3) As for the rest, the execution of computer-based controls of success shall be subject to Articles 6 and 6a.

#### **Article 7 – Evaluation of Coursework and Examinations**

(1) The result of an examination shall be specified by the examiners in the form of a grade.

(2) The following grades shall be used:

sehr gut (very good) for an outstanding performance;

gut (good)	for a performance that is far above the average;
befriedigend (satisfactory)	for a performance meeting average requirements;
ausreichend (sufficient)	for a performance that is still acceptable in spite of its deficiencies;
nicht ausreichend (failed)	for a performance that is no longer acceptable due to major deficiencies.

For the differentiated evaluation of individual examinations, the following grades shall be applied exclusively:

1.0, 1.3	“sehr gut” (very good),
1.7, 2.0, 2.3	“gut” (good),
2.7, 3.0, 3.3	“befriedigend” (satisfactory),
3.7, 4.0	“ausreichend” (sufficient), and
5.0	“nicht ausreichend” (failed).

(3) Coursework shall be evaluated with “bestanden” (passed) or “nicht bestanden” (failed).

(4) When determining the weighted means of module grades, subject grades, and the total grade, only the first decimal place shall be considered. All following decimal places shall be deleted without rounding.

(5) Every module and control of success may only be credited once in the same program.

(6) An examination shall be passed, if the grade is at least “ausreichend” (4.0, sufficient).

(7) A module examination shall be passed, if all required controls of success are passed. The module examination and determination of the module grade shall be outlined in the module manual. If the module manual does not contain any regulation about the determination of the module grade, the module grade shall be calculated

from the grade average weighted according to the credits of the individual partial modules. The differentiated grades (par. 2) shall be used for calculating the module grades.

(8) The results of the controls of success as well as the credits acquired shall be administrated by the Students Office of KIT.

(9) The grades of the modules of a subject shall be considered proportionally to the credits assigned to the modules when calculating the subject grade.

(10) The total grade of the master's examination, the subject grades, and the module grades are:

Down to 1.5	“sehr gut” (very good),
from 1.6 to 2.5	“gut” (good),
from 2.6 to 3.5	“befriedigend” (satisfactory),
from 3.6 to 4.0	“ausreichend” (sufficient).

### **Article 8 – Repetition of Examinations, Ultimate Failure**

(1) Students may repeat once a written examination that has not been passed (Article 4, par. 2, no. 1). In case a repeated written examination is given the grade of “nicht ausreichend” (5.0, failed), an oral reexamination shall take place soon after the date of the failed examination. In this case, the grade of this examination may not be better than “ausreichend” (4.0, sufficient).

(2) Students may repeat once an oral examination that has not been passed (Article 4, par. 2, no. 2).

(3) Repeated examinations according to paragraphs 1 and 2 shall correspond to the first examination in terms of contents, scope, and type (oral or written). At request, exceptions may be approved by the responsible examination committee.

(4) Examinations of another type (Article 4, par. 2, no. 3) can be repeated once.

(5) Coursework can be repeated several times.

(6) An examination shall ultimately not be passed, if an oral reexamination according to par. 1 was evaluated with the grade of “nicht ausreichend” (5.0, failed). The examination also shall ultimately not be passed, if the oral examination according to par. 2 or the examination of another type according to par. 4 was evaluated twice with the grade of “nicht bestanden” (failed).

(7) The module shall ultimately not be passed, if an examination required for passing the module is ultimately not passed.

(8) A second repetition of the same examination according to Article 4, par. 2 shall be possible in exceptional cases at the request of the student only (“Antrag auf Zweitwiederholung” – application for a second repetition). As a rule, the request shall be submitted in writing to the examination committee within two months upon announcement of the grade.

The examination committee shall decide on the first application of a student for a second repetition. If the examination committee dismisses the application, a member of the Executive Board shall decide. Upon comment of the examination committee, a member of the Executive Board shall decide on further applications for a second repetition. If the application is accepted, the second repetition shall take place on the next but one examination date at the latest. Paragraph 1, clauses 2 and 3 shall apply accordingly.

(9) Repetition of a passed examination shall not be permitted.

(10) In case a master’s thesis has been granted the grade “nicht ausreichend” (5.0, failed), it can be repeated once. A second repetition of the master’s thesis shall be excluded.

### **Article 9 – Loss of the Entitlement to an Examination**

In case coursework or an examination required according to the present Studies and Examination Regulations is ultimately not passed or the master's examination, including potential repetitions, is not passed completely by the end of the examination period of the seventh semester, the entitlement to examination in the Master's Program of Materials Science and Engineering shall expire, unless the student is not responsible for having exceeded the deadline. The decision on extending the deadline and on exceptions from the deadline regulations shall be made by the examination committee taking into account the activities listed in Article 32, par. 6, LHG at the request of the student. This request shall be made in writing usually six weeks prior to the expiry of the deadline.

### **Article 10 – Deregistration, Absence, Withdrawal**

(1) Students can revoke their registration for *written examinations* until the issue of the examination tasks without having to indicate any reasons (deregistration). Deregistration can be made online on the Students Portal by 12 pm on the day before the examination or in justified exceptional cases with the Students Office during office hours. If the deregistration is addressed to the examiner, the latter shall ensure that the deregistration is documented in the Campus Management System.

(2) In case of *oral examinations*, deregistration shall be declared to the examiner at least three working days before the date of examination. Withdrawal from an oral examination less than three working days before the date of examination shall be possible under the conditions outlined in par. 5 only. In principle, withdrawal from oral reexaminations in the sense of Article 9, par. 1 shall be possible under the conditions of par. 5 only.

(3) Deregistration from *examinations of another type* and from *coursework* shall be subject to the provisions given in the module manual.

(4) A control of success shall be deemed to have been "nicht ausreichend" (5.0, failed), if students fail to be present at the examination without a good reason or if they withdraw from the control of success after its start without a good reason. The same

shall apply, if the master's thesis is not submitted within the period envisaged, unless the student is not responsible for having exceeded the deadline.

(5) The reason given for withdrawal after the start of the control of success or absence shall be notified immediately, credibly, and in writing to the examination committee. In case of sickness of the student or of a child maintained by the student alone or of a relative in need of care, submission of a medical certificate may be required.

### **Article 11 – Deception, Breach of Regulations**

(1) In case students try to influence the result of their control of success by deception or the use of impermissible aids, this control of success shall be deemed to have been “nicht ausreichend” (5.0, failed).

(2) Students disturbing the proper execution of the control of success may be excluded from the continuation of this control of success by the examiner or supervisor. In this case, the control of success shall be deemed to have been “nicht ausreichend” (5.0, failed). In serious cases, the examination committee can exclude these students from other controls of success.

(3) Details relating to honesty during examinations and internships are outlined in the General Statutes of KIT, as amended.

### **Article 12 – Maternity Protection, Parental Leave, Assumption of Family Obligations**

(1) The provisions given in the Act on the Protection of Mothers at Work, during Education, and during Studies (Mutterschutzgesetz - MuSchG), as amended, shall apply. The maternity protection periods suspend any deadline according to the present examination regulations. The duration of maternity protection shall not be included in the deadline given.

(2) In addition, the deadlines of parental leave shall be considered according to the valid legislation (Bundeselterngeld- und Elternzeitgesetz (Parental Benefit and

Parental Leave Act - BEEG)) at the student's request. Four weeks prior to the desired start of the parental leave period at the latest, the student shall inform the examination committee in writing about the time when she/he wishes to be on parental leave, with the required evidence being enclosed. The examination committee shall then check whether the legal prerequisites would justify an employee's claim for parental leave and inform the student immediately of the result and the new times of examination. The period of work on the master's thesis may not be interrupted by parental leave. In this case, the thesis shall be deemed to have not been assigned. Upon expiry of the parental leave period, the student shall receive a new subject that is to be dealt with within the period defined in Article 14.

(3) At request, the examination committee shall decide on the flexible handling of examination deadlines according to the provisions of the Act of Baden-Württemberg on Universities and Colleges (LHG), if students have to assume family obligations. Paragraph 2, clauses 4 to 6 shall apply accordingly.

### **Article 13 – Students with a Disability or Chronic Disease**

(1) When organizing studies and examinations, the needs of students with a disability or chronic disease shall be considered. In particular, students with a disability or chronic disease shall be granted preferred access to courses with a limited number of participants and the order for passing certain courses shall be adapted to their needs. According to the Federal Equality Act (Bundesgleichstellungsgesetz, BGG) and Vol. 9 of the Social Code (SGB IX), students are disabled, if their bodily function, mental capacity, or emotional health most probably deviates from the state typical of the age for a period longer than six months and, hence, their participation in social life is impaired. At the request of the student, the examination committee shall decide on the existence of conditions outlined in clauses 2 and 3. The student shall submit the required evidence for this purpose.

(2) If students provide evidence of a disability or chronic disease, as a result of which they are not able to pass controls of success completely or partly within the planned time or in the form envisaged, the examination committee may permit controls of

success within other time periods or in another form. In particular, students with a disability or chronic disease shall be permitted to use the required aids.

(3) In case students provide evidence of a disability or chronic disease, as a result of which they are not able to attend courses regularly or to pass the required coursework or examinations as outlined in Article 19, the examination committee may permit at the student's request passing of certain coursework and examinations after the expiry of the deadlines given in the present Studies and Examination Regulations.

#### **Article 14 – Master's Thesis Module**

(1) For admission to the master's thesis module, the module examinations in the amount of 75 credits must have been passed successfully. At the request of the student, the examination committee shall decide on exceptions.

(1a) 30 credits are assigned to the master's thesis module. It consists of the master's thesis and a public presentation. The presentation shall be made within a period of four weeks upon submission of the master's thesis.

(2) The master's thesis can be assigned by university teachers, executive scientists according to Article 14, par. 3, cl. 1, KITG, and habilitated members of the KIT Department of Mechanical Engineering. In addition, the examination committee can authorize other examiners to assign the subject according to Article 17, pars. 2 and 3. The students shall be given the possibility of making proposals relating to the subject. If the master's thesis is to be written outside of the KIT Departments of Mechanical Engineering, Chemistry and Biosciences, Chemical and Process Engineering, Electrical Engineering and Information Technology, or Physics, the approval of the examination committee shall be required. The master's thesis may also be accepted in the form of group work, if the contributions of the individual students to be evaluated in the examination can be distinguished clearly based on objective criteria and if the requirement outlined in par. 4 is fulfilled. In exceptional cases, the chairperson of the examination committee shall take care of the student receiving a subject for the master's thesis within four weeks upon her/his request. In this case, the subject is issued by the chairperson of the examination committee.

(3) The subject, task, and scope of the master's thesis shall be limited by the supervisor such that it can be handled with the expenditure outlined in par. 4.

(4) The master's thesis shall demonstrate that the students are able to deal with a problem of their subject area in an independent manner and within a limited period of time using scientific methods. The scope of the master's thesis shall correspond to 30 credits. The maximum duration of work on the thesis shall amount to six months. The subject and task shall be adapted to the scope envisaged. The examination committee shall specify the languages in which the master's thesis can be written. At the request of the student, the examiner can permit the master's thesis to be written in a language other than German or English.

(5) When submitting the master's thesis, the students shall assure in writing that the thesis is original work by them alone and that they have used no sources and aids other than indicated, marked all citations in word and content, and observed the Statutes of KIT for Safeguarding Good Scientific Practice, as amended. If this declaration is not contained, the thesis will not be accepted. The wording of the declaration may be: "Ich versichere wahrheitsgemäß, die Arbeit selbständig verfasst, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben." (I herewith declare that the present thesis is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications, and that I have observed the Statutes of KIT for Safeguarding Good Scientific Practice, as amended).

If the declaration is found to be not true, the master's thesis shall be evaluated "nicht ausreichend" (5.0, failed).

(6) The time of assignment of the subject of the master's thesis shall be recorded by the supervisor and the student/s and documented in the files of the examination committee. The time of submission of the master's thesis shall be recorded in the files of the examination committee by the examiner. The student shall be allowed to return

the subject of the master's thesis once only within the first month of the period of work on the thesis. At the justified request of the student, the examination committee may extend the time of work on the thesis given in par. 4 by three months at the maximum. If the master's thesis is not submitted in time, it shall be deemed to have been "nicht ausreichend" (5.0, failed), unless the student is not responsible for this failure.

(7) The master's thesis shall be evaluated by a university teacher, an executive scientist according to Article 14, par. 3, cl. 1, KITG, or a habilitated member of the KIT Department of Mechanical Engineering and another examiner at least. As a rule, one of the examiners is the person who assigned the thesis according to par. 2. In case of deviating evaluations of both persons, the examination committee shall fix the grade of the master's thesis within the limits of the evaluations of both persons. It may also appoint another expert. The evaluation period shall not exceed eight weeks upon submission of the master's thesis.

#### **Article 14 a – Internship**

(1) During the master's program, an internship of at least nine weeks must be passed, which is suited to give the students an idea of professional work in the area of Materials Science and Engineering. The internship is assigned 12 credits.

(2) In their own responsibility, the students shall contact appropriate private or public institutions, where the internship may be passed. Details are outlined in the module manual.

#### **Article 15 – Additional Achievements**

(1) Further credits (additional achievements) in the amount of 30 credits at the maximum may be acquired in the courses offered by KIT. Articles 3 and 4 of the examination regulations shall remain unaffected. These additional achievements shall not be considered when calculating the total and module grades. The credits not considered when determining the module grade shall be listed and marked as additional achievements in the transcript of records. At the student's request, additional achievements shall be indicated in the master's certificate and marked as additional

achievements. Additional achievements shall be listed with the grades outlined in Article 7.

(2) The students shall declare a module examination an additional achievement when registering for this examination already.

#### **Article 15a – Transferable Skills**

Apart from scientific qualifications, KIT attaches high importance to transferable skills. These transferable skills of 4 credits shall be part of the Master's Program of Materials Science and Engineering. Transferable skills may be imparted additively or integratively.

#### **Article 16 – Examination Committee**

(1) For the Master's Program of Materials Science and Engineering, an examination committee shall be formed. It shall consist of 4 members entitled to vote, 2 university teachers/executive scientists according to Article 14, par. 3, cl. 1, KITG/assistant professors and two academic staff members according to Article 52, LHG/scientific staff members according to Art. 14, par. 3, cl. 2, KITG, as well as one student with an advisory vote. In case of the establishment of a joint examination committee for the Bachelor's and Master's Programs of Materials Science and Engineering, the number of students is increased to two members with an advisory vote, with one of them coming from the bachelor's program and one from the master's program. The term of office of the non-student members shall be two years, the term of office of the student member shall be one year.

(2) The chairperson, her/his deputy, the other members of the examination committee, and their deputies shall be appointed by the KIT Department Council. The members of the group of academic staff according to Article 52, LHG, the scientific staff members according to Article 14, par. 3, cl. 2, KITG, and the students shall be proposed by the members of the respective groups. Reappointment shall be possible. The chairperson and her/his deputy shall be university teachers or executive scientists according to Article 14, par. 3, cl. 1, KITG. The chairperson of the examination committee shall be

responsible for current transactions and supported by the respective examination office.

(3) The examination committee shall take care of the provisions of the present Studies and Examination Regulations being observed and shall decide on examination matters. It shall decide on the recognition of study periods, coursework, and examinations according to Article 18, par. 1, cl. 1. It shall regularly report to the KIT Department about the development of examination and study periods as well as about the times of work on the master's theses and the distribution of module and total grades. It shall make suggestions for reforms of the Studies and Examination Regulations and module descriptions. The examination committee shall decide with the majority of its votes. In the case of a split vote, the chairperson of the examination committee shall decide.

(4) The examination committee may delegate the execution of its tasks for all standard cases to its chairperson. In urgent cases that cannot be postponed until the next meeting of the examination committee, the chairperson of the examination committee shall decide.

(5) The members of the examination committee shall have the right to participate in examinations. The members of the examination committee, the examiners, and the associates shall be obliged to secrecy. If they do not work in the public service sector, they shall be obliged to secrecy by the chairperson.

(6) In matters of the examination committee, which are related to an examination to be passed at another KIT Department, a competent person authorized to examine and to be appointed by the respective KIT Department shall be consulted at the request of a member of the examination committee.

(7) The student shall be informed in writing about incriminating decisions by the examination committee. These decisions shall be justified and provided with an information on legal remedies available. Prior to a decision, the student shall be given the opportunity to comment. Objections against decisions made by the examination committee shall be made to the examination committee within one month upon receipt

of the decision. In case of objections, the executive board member responsible for higher education shall decide.

#### **Article 17 – Examiners and Associates**

(1) The examination committee shall appoint the examiners. It may transfer this task to its chairperson.

(2) Examiners shall be university teachers and executive scientists according to Article 14, par. 3, cl. 1, KITG, habilitated members, and academic staff members according to Article 52, LHG from the respective KIT Department, who have been authorized to examine students; scientific staff members according to Article 14, par. 3, cl. 2, KITG may also be authorized to examine. For appointment as examiner, persons shall have the scientific qualification corresponding to the examination subject at least.

(3) If courses are held by persons other than those mentioned in par. 2, these shall be appointed examiners, if they have the scientific qualification required in par. 2, cl. 2. External persons may also be appointed examiners of a master's thesis, provided that they can prove that they have the qualification outlined in par. 2, cl. 2.

(4) Associates shall be appointed by the examiners. Persons having completed a master's program of mathematics, natural sciences, or engineering sciences or having an equivalent academic degree only may be appointed associate.

#### **Article 18 – Recognition of Coursework and Examinations as well as of Study Periods**

(1) Coursework and examinations made as well as study periods passed in study programs at state or state-recognized universities and cooperative state universities of the Federal Republic of Germany or at foreign state or state-recognized universities shall be recognized at the request of the students, if the competences acquired do not differ considerably from the achievements or degrees to be replaced. For this, no schematic comparison, but an overall analysis shall be made. As regards the scope of

a coursework or examination to be recognized, the principles of the ECTS shall be applied.

(2) The students shall submit the documents required for recognition. Students newly enrolled in the Master's Program of Materials Science and Engineering shall submit the application together with the documents required for recognition within one semester upon enrollment. If documents are not available in the German or English language, an officially certified translation may be requested. The examination committee shall bear the burden of proving that the application does not meet the recognition requirements.

(3) If achievements not made at the KIT are recognized, they are listed as "anerkannt" (recognized) in the certificate. If grades exist, they shall be taken over in case of comparable grade scales and shall be included in the calculation of module grades and the total grade. In case of incomparable grade systems, the grades can be converted. In the absence of grades, the note "bestanden" (passed) shall be entered.

(4) When recognizing coursework and examinations passed outside of the Federal Republic of Germany, the equivalence agreements adopted by the Conference of Ministers of Education and the German Rectors' Conference as well as agreements concluded within the framework of university partnerships shall be considered.

(5) Knowledge and skills acquired outside of the university system shall be recognized, if they are equivalent to the coursework and examinations to be replaced in terms of contents and level and if the institution, where the knowledge and skills were acquired, has a standardized quality assurance system. Recognition may be refused in parts, if more than 50% of the university's study program are to be replaced.

(6) The examination committee shall be responsible for recognitions. To determine whether a considerable difference in the sense of par. 1 exists, the responsible subject representatives shall be heard. Depending on the type and scope of coursework and examinations to be recognized, the examination committee shall decide on admission to a higher semester.

## **II. Master's Examination**

### **Article 19 – Scope and Type of the Master's Examination**

(1) The master's examination shall consist of the module examinations according to par. 2 and the master's thesis module (Article 14) as well as the internship (Article 14a).

(2) Module examinations shall be passed in the following mandatory subjects:

1. Materials science specialization: Module(s) in the amount of 30 credits
2. Focus I: Module(s) in the amount of 16 credits
3. Focus II: Module(s) in the amount of 16 credits
4. Interdisciplinary complementary course(s): Module(s) in the amount of 12 credits
5. Transferable skills: Module(s) in the amount of 4 credits according to Art. 15a.

The modules available for selection and their allocation to subjects shall be specified in the module manual.

### **Article 19a – Certificates of Achievements for the Master's Examination**

Registration for the last module examination of the master's examination procedure requires the certificate of a successfully passed internship according to Article 14a. In exceptional cases for which the students are not responsible, the examination committee may permit later submission of this certificate.

### **Article 20 – Passing of the Master's Examination, Calculation of the Total Grade**

(1) The master's examination shall be passed, if all module examinations mentioned in Article 19 were evaluated with the grade "ausreichend" (sufficient) at least and all achievements listed in Article 19 were passed.

(2) The total grade of the master's examination shall be the mean of the subject grades and the master's thesis module weighted with the credits.

(3) In case the students have completed the master's thesis with the grade 1.0 and the master's examination with an average of 1.2 or better, the predicate "mit Auszeichnung" (with distinction) shall be granted.

#### **Article 21 – Master's Transcript, Master's Certificate, Diploma Supplement, and Transcript of Records**

(1) Upon evaluation of the last examination, a master's certificate and a transcript shall be issued about the master's examination not later than three months upon the last examination. The master's certificate and transcript shall be issued in the German and English languages. The master's certificate and transcript shall bear the date of the successful passing of the last examination. They shall be handed over to the students together. The master's certificate shall document conferral of the academic master's degree. The master's certificate shall be signed by the President and the KIT Dean of the KIT Department and provided with the seal of KIT.

(2) The transcript shall list the subject and module grades, the credits assigned to the modules and subjects, and the total grade. If a differentiated evaluation of individual examinations was made according to Article 7, par. 2, cl. 2, the respective decimal grade shall be indicated in the transcript. Article 7, par. 4 shall remain unaffected. The transcript shall be signed by the KIT Dean of the KIT Department and the chairperson of the examination committee.

(3) In addition, the students shall be given a diploma supplement in the German and English languages, which corresponds to the requirements of the applicable ECTS Users' Guide, as well as a transcript of records in German and English.

(4) The transcript of records shall list all coursework and examinations passed by the student in a structured form. It shall include all subjects and subject grades as well as the assigned credits, the modules assigned to the respective subject with the module grades and the credits assigned, as well as the controls of success assigned to the modules together with the grades and the credits. Paragraph 2, cl. 2 shall apply accordingly. The transcript of records shall clearly reflect the assignment of controls of success to the individual modules. Recognized coursework and examinations shall be

included in the transcript of records. All additional achievements shall be listed in the transcript of records.

(5) The master's certificate, master's transcript, and the diploma supplement, including the transcript of records, shall be issued by the Students Office of the KIT.

### **III. Final Provisions**

#### **Article 22 – Certificate of Examination Achievements**

In case students have ultimately failed in the master's examination, they shall be given at request and against submission of the exmatriculation certificate a written certificate about the coursework and examinations made, the respective grades, as well as the confirmation that the overall examination has not been passed. The same shall apply when the entitlement to an examination has expired.

#### **Article 23 – Deprivation of the Master's Degree**

(1) If students have been guilty of deception during an examination and if this fact becomes known upon the hand-over of the certificates only, the grades of the module examinations, during which the students were guilty of deception, can be corrected. If applicable, this module examination may be declared to have been "nicht ausreichend" (5.0, failed) and the master's examination may be declared to have been "nicht bestanden" (failed).

(2) If the conditions for admission to an examination were not fulfilled without the student wanting to deceive and if this fact becomes known upon the hand-over of the certificate only, this default shall be remedied by the passing of the examination. If the student intentionally and wrongly obtained admission to the examination, the module examination may be declared to have been "nicht ausreichend" (5.0, failed) and the master's examination may be declared to have been "nicht bestanden" (failed).

(3) Prior to a decision of the examination committee, the student shall be given the opportunity to comment.

(4) The incorrect certificate shall be confiscated and, if applicable, a new certificate shall be issued. Together with the incorrect certificate, the master's certificate shall also be confiscated, if the master's examination was declared to have been "nicht bestanden" (failed) due to a deception.

(5) A decision pursuant to par. 1 and par. 2, cl. 2 shall be excluded after a period of five years upon the date of issue of the certificate.

(6) Deprivation of the academic degree shall be subject to Article 36, par. 7, LHG.

#### **Article 24 – Inspection of Examination Files**

(1) Upon completion of the master's examination, the students shall be granted the right to inspect the examination copy of their master's theses, the related opinions, and minutes of the examinations within one year at request.

(2) For inspection of the written module examinations, written module part examinations, and examination minutes, a deadline of one month after announcement of the examination result shall apply.

(3) The examiner shall determine the place and time of inspection.

(4) Examination documents shall be kept for at least five years.

#### **Article 25 – Entry into Force, Transition Regulations**

(1) The present Studies and Examination Regulations shall enter into force on October 01, 2017 and shall apply to

1. students who start studies within the Master's Program of Materials Science and Engineering at KIT in the first semester and to
2. students who start their studies within the Master's Program of Materials Science and Engineering at KIT in a higher semester, provided that this semester does not exceed the semester reached by the first year according to cl. 1.

(2) The Studies and Examination Regulations for the Master's Program of Materials Science and Engineering (MWT) of June 30, 2011 (Official Announcement of KIT No. 38 of June 30, 2011), as amended by the Statutes for Implementation of the Convention on the Recognition of Qualifications Concerning Higher Education in the European Region of April 11, 1997 (Lisbon Convention) according to Articles 32, pars. 2, 4 and 36a, LHG in the Studies and Examination Regulations of Karlsruhe Institute of Technology (KIT) dated March 27, 2014 (Official Announcement of KIT No. 19 of March 28, 2014) shall remain valid for

1. students who last started their studies within the Master's Program of Materials Science and Engineering at KIT in the summer semester 2017 as well as for
2. students who start their studies within the Master's Program of Materials Science and Engineering at KIT in a higher semester as of the 2017/18 winter semester, if the higher semester exceeds the semester reached by the first year according to par. 1, cl. 1.

As for the rest, the above Studies and Examination Regulations cease to be in force.

(3) Students who started their studies at KIT based on the Studies and Examination Regulations of KIT for the Master's Program of Materials Science and Engineering (MWT) of June 30, 2011 (Official Announcement of KIT No. 38 of June 30, 2011), as amended by the Statutes for Implementation of the Convention on the Recognition of Qualifications Concerning Higher Education in the European Region of April 11, 1997 (Lisbon Convention) according to Articles 32, pars. 2, 4 and 36a LHG in the Studies and Examination Regulations of Karlsruhe Institute of Technology (KIT) dated March 27, 2014 (Official Announcement of KIT No. 19 of March 28, 2014) may pass examinations based on these Studies and Examination Regulations until the end of the examination period of the 2022 summer semester for the last time.

(4) Article 15, par. 2 of the Studies and Examination Regulations of Karlsruhe Institute of Technology (KIT) for the Master's Program of Materials Science and Engineering of June 26, 2017 (Official Announcement of Karlsruhe Institute of Technology (KIT) No. 48 of June 27, 2017), last amended by Article 59 of the Statutes of September 03, 2020 (Official Announcement of Karlsruhe Institute of Technology (KIT) No. 49 of September 04, 2020) shall remain applicable until the end of the 2021/2022 winter

semester to students who started their studies in the Master's Program of Materials Science and Engineering prior to the 2022 summer semester.

Karlsruhe, October 20, 2021

*Professor Dr.-Ing. Holger Hanselka*

*(President)*