Module Handbook
KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)
SPO (none)
Summer term 2024
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KIT DEPARTMENT OF MECHANICAL ENGINEERING
# Table Of Contents

## 1. Field of study structure

1.1. Courses of the KIT Department of Mechanical Engineering .............................................. 10
1.2. Courses of Other KIT Departments and Interdisciplinary Qualifications .......................... 10

## 2. Modules

2.1. Courses of the KIT Department of Architecture - M-MACH-106251 .................................. 11
2.2. Courses of the KIT Department of Chemical and Process Engineering - M-MACH-105100 ..... 11
2.3. Courses of the KIT Department of Chemistry and Biosciences - M-MACH-106252 .......... 14
2.4. Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences - M-MACH-105405 14
2.5. Courses of the KIT Department of Economics and Management - M-MACH-104884 .... 15
2.6. Courses of the KIT Department of Electrical Engineering and Information Technology - M-MACH-104882 16
2.7. Courses of the KIT Department of Humanities and Social Sciences - M-MACH-106253 18
2.8. Courses of the KIT Department of Informatics - M-MACH-104883 19
2.9. Courses of the KIT Department of Mathematics - M-MACH-104885 20
2.10. Courses of the KIT Department of Mechanical Engineering - M-MACH-106250 ........ 21
2.11. Courses of the KIT Department of Physics - M-MACH-106254 29
2.12. Key Competences - M-MACH-106255 30
2.13. Project - M-MACH-104840 31

## 3. Courses

3.1. Actuators and Sensors in Nanotechnology - T-MACH-105238 ........................................ 32
3.2. Advanced Mathematics III - T-MATH-108270 ................................................................. 33
3.3. Advanced Mathematics III Prerequisite - T-MATH-108269 ............................................. 34
3.4. Airport Logistics - T-MACH-105175 .......................................................... 35
3.5. Alternative Powertrain for Automobiles - T-MACH-105655 ........................................ 37
3.6. Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines - T-MACH-105173 .... 38
3.8. Applied Building Physics - T-BGU-100039 ................................................................. 40
3.9. Applied Materials Simulation - T-MACH-105527 .......................................................... 41
3.10. Applied Mathematics in Natural Science: Flows with chemical reactions - T-MACH-108847 43
3.11. Applied Tribology in Industrial Product Development - T-MACH-105215 ................ 44
3.12. Atomistic Simulations and Particle Dynamics - T-MACH-113412 45
3.13. Automated Manufacturing Systems - T-MACH-108844 ........................................... 46
3.15. Automotive Engineering I - T-MACH-100092 ............................................................ 49
3.16. Automotive Engineering II - T-MACH-102117 ............................................................ 51
3.17. Automotive Vision - T-MACH-105218 ................................................................. 53
3.18. Basics in Measurement and Control Systems - T-MACH-104745 ............................. 54
3.20. Basics of Manufacturing Technology (MEI) - T-MACH-108747 .............................. 58
3.22. Basics of Technical Logistics II - T-MACH-109920 .................................................... 62
3.23. Batteries and Fuel Cells - T-CHEM/112316 .............................................................. 63
3.24. Behaviour Generation for Vehicles - T-MACH-105367 ........................................... 64
3.25. Bioelectric Signals - T-ETIT-101956 ................................................................. 66
3.27. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I - T-MACH-100966 68
3.28. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II - T-MACH-100967 69
3.29. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III - T-MACH-100968 70
3.30. Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning - T-MACH-113359 71
3.31. Building Technology - T-BGU-100040 ................................................................. 73
3.32. Business Administration for Engineers and IT Professionals - T-MACH-109933 74
3.33. CAD-NX Training Course - T-MACH-102187 .......................................................... 76
3.34. CAE-Workshop - T-MACH-105212 ................................................................. 78
3.35. CATIA Advanced - T-MACH-105312 ................................................................. 80
3.36. CATIA CAD Training Course - T-MACH-102185 .................................................... 81
3.37. CFD for Power Engineering - T-MACH-105407 ...................................................... 83
3.38. CFD-Lab Using OpenFOAM - T-MACH-105313 ..................................................... 85
3.40. Coal Fired Power Plants - T-MACH-105410 .......................................................... 87
3.41. Cognitive Automobiles - Laboratory - T-MACH-105378 ........................................ 88
### Module Handbook as of 23/02/2024

<table>
<thead>
<tr>
<th>Table Of Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.42. Combined Cycle Power Plants - T-MACH-105444</td>
<td>89</td>
</tr>
<tr>
<td>3.43. Combustion Engines I - T-MACH-102194</td>
<td>90</td>
</tr>
<tr>
<td>3.44. Combustion Engines II - T-MACH-104609</td>
<td>91</td>
</tr>
<tr>
<td>3.45. Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies - T-MACH-105535</td>
<td>92</td>
</tr>
<tr>
<td>3.46. Computational Dynamics - T-MACH-105349</td>
<td>94</td>
</tr>
<tr>
<td>3.47. Computational Intelligence - T-MACH-105314</td>
<td>95</td>
</tr>
<tr>
<td>3.48. Computational Mechanics I - T-MACH-105351</td>
<td>97</td>
</tr>
<tr>
<td>3.49. Computational Mechanics II - T-MACH-105352</td>
<td>98</td>
</tr>
<tr>
<td>3.50. Computational Vehicle Dynamics - T-MACH-105350</td>
<td>99</td>
</tr>
<tr>
<td>3.51. Computer Science for Engineers - T-MACH-105205</td>
<td>101</td>
</tr>
<tr>
<td>3.52. Computer Science for Engineers, Prerequisite - T-MACH-105206</td>
<td>103</td>
</tr>
<tr>
<td>3.53. Computerized Multibody Dynamics - T-MACH-105384</td>
<td>104</td>
</tr>
<tr>
<td>3.54. Constitution and Properties of Protective Coatings - T-MACH-105150</td>
<td>105</td>
</tr>
<tr>
<td>3.56. Contact Mechanics - T-MACH-105786</td>
<td>109</td>
</tr>
<tr>
<td>3.57. Continuum Mechanics of Solids and Fluids - T-MACH-110377</td>
<td>110</td>
</tr>
<tr>
<td>3.58. Control of Mobile Machines - T-MACH-111821</td>
<td>111</td>
</tr>
<tr>
<td>3.59. Control of Mobile Machines – Prerequisites - T-MACH-111820</td>
<td>112</td>
</tr>
<tr>
<td>3.60. Control Technology - T-MACH-105185</td>
<td>113</td>
</tr>
<tr>
<td>3.61. Cryogenic Engineering - T-CIWVT-108915</td>
<td>115</td>
</tr>
<tr>
<td>3.62. Data Analytics for Engineers - T-MACH-105694</td>
<td>116</td>
</tr>
<tr>
<td>3.63. Design and Development of Mobile Machines - T-MACH-105311</td>
<td>117</td>
</tr>
<tr>
<td>3.64. Design and Development of Mobile Machines - Advance - T-MACH-108887</td>
<td>119</td>
</tr>
<tr>
<td>3.65. Design and Optimization of Conventional and Electrified Automotive Transmissions - T-MACH-110958</td>
<td>120</td>
</tr>
<tr>
<td>3.66. Design of a Jet Engine Combustion Chamber - T-CIWVT-110571</td>
<td>121</td>
</tr>
<tr>
<td>3.67. Design of Highly Stresses Components - T-MACH-105310</td>
<td>122</td>
</tr>
<tr>
<td>3.68. Design with Plastics - T-MACH-105330</td>
<td>123</td>
</tr>
<tr>
<td>3.69. Designing with Composites - T-MACH-108721</td>
<td>125</td>
</tr>
<tr>
<td>3.70. Development of Oil-Hydraulic Powertrain Systems - T-MACH-105441</td>
<td>126</td>
</tr>
<tr>
<td>3.71. Differential Equations - Exam - T-MATH-103323</td>
<td>127</td>
</tr>
<tr>
<td>3.72. Digital Control - T-MACH-105317</td>
<td>128</td>
</tr>
<tr>
<td>3.73. Digital Technology - T-ETIT-101918</td>
<td>129</td>
</tr>
<tr>
<td>3.74. Digitization in the Railway System - T-MACH-113016</td>
<td>130</td>
</tr>
<tr>
<td>3.75. Drive Systems and Possibilities to Increase Efficiency - T-MACH-105451</td>
<td>131</td>
</tr>
<tr>
<td>3.76. Drive Train of Mobile Machines - T-MACH-105307</td>
<td>132</td>
</tr>
<tr>
<td>3.77. Dynamics of the Automotive Drive Train - T-MACH-105226</td>
<td>134</td>
</tr>
<tr>
<td>3.78. Elasticity as a Field Theory - T-MACH-112215</td>
<td>135</td>
</tr>
<tr>
<td>3.80. Electric Power Generation and Power Grid - T-ETIT-103608</td>
<td>137</td>
</tr>
<tr>
<td>3.81. Electric Power Transmission &amp; Grid Control - T-ETIT-110883</td>
<td>138</td>
</tr>
<tr>
<td>3.82. Electrical Engineering and Electronics - T-ETIT-108386</td>
<td>139</td>
</tr>
<tr>
<td>3.83. Electrical Engineering and Electronics - T-ETIT-109820</td>
<td>140</td>
</tr>
<tr>
<td>3.84. Electrical Machines and Power Electronics - T-ETIT-101954</td>
<td>141</td>
</tr>
<tr>
<td>3.85. Electronic Devices and Circuits - T-ETIT-109318</td>
<td>142</td>
</tr>
<tr>
<td>3.86. Energy and Process Technology I - T-MACH-102211</td>
<td>143</td>
</tr>
<tr>
<td>3.87. Energy and Process Technology II - T-MACH-102212</td>
<td>144</td>
</tr>
<tr>
<td>3.88. Energy Conversion and Increased Efficiency in Internal Combustion Engines - T-MACH-105564</td>
<td>145</td>
</tr>
<tr>
<td>3.89. Energy Demand of Buildings – Fundamentals and Applications, with Building Simulation Exercises - T-MACH-105715</td>
<td>146</td>
</tr>
<tr>
<td>3.90. Energy from Biomass - T-CIWVT-110576</td>
<td>147</td>
</tr>
<tr>
<td>3.92. Energy Storage and Network Integration - T-MACH-105952</td>
<td>149</td>
</tr>
<tr>
<td>3.93. Energy Storage and Network Integration - T-ETIT-104644</td>
<td>150</td>
</tr>
<tr>
<td>3.95. Energy Systems II: Reactor Physics - T-MACH-105550</td>
<td>152</td>
</tr>
<tr>
<td>3.96. Engine Laboratory - T-MACH-105337</td>
<td>154</td>
</tr>
<tr>
<td>3.97. Engine Measurement Techniques - T-MACH-105169</td>
<td>155</td>
</tr>
<tr>
<td>3.98. Engineering Materials for the Energy Transition - T-MACH-109082</td>
<td>156</td>
</tr>
<tr>
<td>3.100. Engineering Mechanics III - T-MACH-112906</td>
<td>159</td>
</tr>
<tr>
<td>3.101. Engineer's Field of Work - T-MACH-105721</td>
<td>160</td>
</tr>
<tr>
<td>3.102. Entrepreneurship - T-WIWI-102864</td>
<td>161</td>
</tr>
<tr>
<td>3.103.</td>
<td>Exercises - Fatigue of Welded Components and Structures - T-MACH-109304</td>
</tr>
<tr>
<td>3.104.</td>
<td>Exercises - Tribology - T-MACH-109303</td>
</tr>
<tr>
<td>3.105.</td>
<td>Exercises for Applied Materials Simulation - T-MACH-107671</td>
</tr>
<tr>
<td>3.106.</td>
<td>Exercises for Materials Characterization - T-MACH-107685</td>
</tr>
<tr>
<td>3.108.</td>
<td>Exercises for Microstructure-Property-Relationships - T-MACH-110930</td>
</tr>
<tr>
<td>3.110.</td>
<td>Experimental Dynamics - T-MACH-105514</td>
</tr>
<tr>
<td>3.111.</td>
<td>Experimental Fluid Mechanics - T-MACH-105512</td>
</tr>
<tr>
<td>3.112.</td>
<td>Experimental Lab Class in Welding Technology, in Groups - T-MACH-102099</td>
</tr>
<tr>
<td>3.113.</td>
<td>Fabrication Processes in Microsystem Technology - T-MACH-102166</td>
</tr>
<tr>
<td>3.114.</td>
<td>Failure Analysis - T-MACH-105724</td>
</tr>
<tr>
<td>3.115.</td>
<td>Failure of Structural Materials: Deformation and Fracture - T-MACH-102140</td>
</tr>
<tr>
<td>3.117.</td>
<td>Fatigue of Materials - T-MACH-112106</td>
</tr>
<tr>
<td>3.118.</td>
<td>Fatigue of Welded Components and Structures - T-MACH-105984</td>
</tr>
<tr>
<td>3.119.</td>
<td>FEM Workshop - Constitutive Laws - T-MACH-105392</td>
</tr>
<tr>
<td>3.120.</td>
<td>Financial Analysis - T-WIWI-102900</td>
</tr>
<tr>
<td>3.121.</td>
<td>Finite Difference Methods for Numerical Solution of Thermal and Fluid Dynamical Problems - T-MACH-105391</td>
</tr>
<tr>
<td>3.122.</td>
<td>Finite Element Workshop - T-MACH-105417</td>
</tr>
<tr>
<td>3.123.</td>
<td>Flows and Heat Transfer in Energy Technology - T-MACH-105403</td>
</tr>
<tr>
<td>3.124.</td>
<td>Flows with Chemical Reactions - T-MACH-105422</td>
</tr>
<tr>
<td>3.127.</td>
<td>Fluid Power Systems - T-MACH-102093</td>
</tr>
<tr>
<td>3.128.</td>
<td>Fluid-Structure-Interaction - T-MACH-105474</td>
</tr>
<tr>
<td>3.129.</td>
<td>Foundations of Nonlinear Continuum Mechanics - T-MACH-105324</td>
</tr>
<tr>
<td>3.130.</td>
<td>Foundry Technology - T-MACH-105157</td>
</tr>
<tr>
<td>3.131.</td>
<td>Fuels and Lubricants for Combustion Engines - T-MACH-105184</td>
</tr>
<tr>
<td>3.132.</td>
<td>Functional Ceramics - T-MACH-105179</td>
</tr>
<tr>
<td>3.133.</td>
<td>Fundamental Numerical Algorithms for Engineers - T-BGU-109953</td>
</tr>
<tr>
<td>3.136.</td>
<td>Fundamentals in the Development of Commercial Vehicles - T-MACH-111389</td>
</tr>
<tr>
<td>3.137.</td>
<td>Fundamentals of Automobile Development I - T-MACH-105162</td>
</tr>
<tr>
<td>3.138.</td>
<td>Fundamentals of Automobile Development II - T-MACH-105163</td>
</tr>
<tr>
<td>3.139.</td>
<td>Fundamentals of Catalytic Exhaust Gas Aftertreatment - T-MACH-105044</td>
</tr>
<tr>
<td>3.140.</td>
<td>Fundamentals of Combustion Engine Technology - T-MACH-105652</td>
</tr>
<tr>
<td>3.141.</td>
<td>Fundamentals of Combustion I - T-MACH-105213</td>
</tr>
<tr>
<td>3.142.</td>
<td>Fundamentals of Energy Technology - T-MACH-105220</td>
</tr>
<tr>
<td>3.143.</td>
<td>Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Plants - T-MACH-105530</td>
</tr>
<tr>
<td>3.144.</td>
<td>Fusion Technology A - T-MACH-105411</td>
</tr>
<tr>
<td>3.145.</td>
<td>Fusion Technology B - T-MACH-105433</td>
</tr>
<tr>
<td>3.146.</td>
<td>Gear Cutting Technology - T-MACH-102148</td>
</tr>
<tr>
<td>3.147.</td>
<td>Global Logistics - T-MACH-105379</td>
</tr>
<tr>
<td>3.149.</td>
<td>Global Production and Logistics - Part 2: Global Logistics - T-MACH-105159</td>
</tr>
<tr>
<td>3.150.</td>
<td>Handling Characteristics of Motor Vehicles I - T-MACH-105152</td>
</tr>
<tr>
<td>3.151.</td>
<td>Handling Characteristics of Motor Vehicles II - T-MACH-105153</td>
</tr>
<tr>
<td>3.152.</td>
<td>Hands-on BioMEMS - T-MACH-106746</td>
</tr>
<tr>
<td>3.155.</td>
<td>Heat Transfer in Nuclear Reactors - T-MACH-105529</td>
</tr>
<tr>
<td>3.156.</td>
<td>Heatpumps - T-MACH-105430</td>
</tr>
<tr>
<td>3.159.</td>
<td>High Temperature Materials - T-MACH-105459</td>
</tr>
<tr>
<td>3.162.</td>
<td>Human Factors Engineering I - T-MACH-105518</td>
</tr>
<tr>
<td>3.163.</td>
<td>Human Factors Engineering II - T-MACH-105519</td>
</tr>
<tr>
<td>Module Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>T-INFO-101266</td>
<td>Human-Machine-Interaction</td>
</tr>
<tr>
<td>T-ETIT-100784</td>
<td>Hybrid and Electric Vehicles</td>
</tr>
<tr>
<td>T-MACH-105326</td>
<td>Hydraulic Fluid Machinery</td>
</tr>
<tr>
<td>T-CHEMBO-112317</td>
<td>Hydrogen as Energy Carrier</td>
</tr>
<tr>
<td>T-MACH-112159</td>
<td>Hydrogen in Materials – Exercises and Lab Course</td>
</tr>
<tr>
<td>T-MACH-110923</td>
<td>Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement</td>
</tr>
<tr>
<td>T-MACH-105416</td>
<td>Hydrogen Technologies</td>
</tr>
<tr>
<td>T-MACH-105375</td>
<td>Industrial Aerodynamics</td>
</tr>
<tr>
<td>T-ETIT-100716</td>
<td>Industrial Circuitry</td>
</tr>
<tr>
<td>T-INFO-101466</td>
<td>Information Processing in Sensor Networks</td>
</tr>
<tr>
<td>T-MACH-102128</td>
<td>Information Systems and Supply Chain Management</td>
</tr>
<tr>
<td>T-MACH-113068</td>
<td>Innovation and Project Management in Rail Vehicle Engineering</td>
</tr>
<tr>
<td>T-MACH-112882</td>
<td>Innovation2Business – Innovation Strategy in the Industrial Corporate Practice</td>
</tr>
<tr>
<td>T-MACH-105404</td>
<td>Innovative Nuclear Systems</td>
</tr>
<tr>
<td>T-MACH-109185</td>
<td>Innovative Project</td>
</tr>
<tr>
<td>T-MACH-102083</td>
<td>Integrated Information Systems for Engineers</td>
</tr>
<tr>
<td>T-MACH-108849</td>
<td>Integrated Production Planning in the Age of Industry 4.0</td>
</tr>
<tr>
<td>T-MACH-105188</td>
<td>Integrative Strategies in Production and Development of High Performance Cars</td>
</tr>
<tr>
<td>T-MACH-105442</td>
<td>Intellectual Property Rights and Strategies in Industrial Companies</td>
</tr>
<tr>
<td>T-MACH-100539</td>
<td>Introduction into Mechatronics</td>
</tr>
<tr>
<td>T-MACH-111807</td>
<td>Introduction to Bionics</td>
</tr>
<tr>
<td>T-MACH-100287</td>
<td>Introduction to Ceramics</td>
</tr>
<tr>
<td>T-MACH-108808</td>
<td>Introduction to Engineering Mechanics I: Statics</td>
</tr>
<tr>
<td>T-MACH-102208</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials</td>
</tr>
<tr>
<td>T-MACH-105388</td>
<td>Introduction to Industrial Production Economics</td>
</tr>
<tr>
<td>T-MACH-105182</td>
<td>Introduction to Microsystem Technology I</td>
</tr>
<tr>
<td>T-MACH-105183</td>
<td>Introduction to Microsystem Technology II</td>
</tr>
<tr>
<td>T-MACH-105209</td>
<td>Introduction to Multi-Body Dynamics</td>
</tr>
<tr>
<td>T-MACH-111814</td>
<td>Introduction to nanotechnology</td>
</tr>
<tr>
<td>T-MACH-105466</td>
<td>Introduction to Neutron Cross Section Theory and Nuclear Data Generation</td>
</tr>
<tr>
<td>T-MACH-105439</td>
<td>Introduction to Nonlinear Vibrations</td>
</tr>
<tr>
<td>T-MACH-105525</td>
<td>Introduction to Nuclear Energy</td>
</tr>
<tr>
<td>T-WIWI-102758</td>
<td>Introduction to Operations Research I and II</td>
</tr>
<tr>
<td>T-MACH-105320</td>
<td>Introduction to the Finite Element Method</td>
</tr>
<tr>
<td>T-MACH-105321</td>
<td>Introduction to the Theory of Materials</td>
</tr>
<tr>
<td>T-MACH-106743</td>
<td>IoT Platform for Engineering</td>
</tr>
<tr>
<td>T-MACH-105341</td>
<td>Lab Computer-Aided Methods for Measurement and Control</td>
</tr>
<tr>
<td>T-MACH-105331</td>
<td>Laboratory Exercise in Energy Technology</td>
</tr>
<tr>
<td>T-MACH-102154</td>
<td>Laboratory Laser Materials Processing</td>
</tr>
<tr>
<td>T-MACH-105370</td>
<td>Laboratory Mechatronics</td>
</tr>
<tr>
<td>T-ETIT-104866</td>
<td>Laboratory Solar Energy</td>
</tr>
<tr>
<td>T-MACH-105164</td>
<td>Laser in Automotive Engineering</td>
</tr>
<tr>
<td>T-MACH-112763</td>
<td>Laser Material Processing</td>
</tr>
<tr>
<td>T-MACH-105440</td>
<td>Leadership and Conflict Management</td>
</tr>
<tr>
<td>T-MACH-105231</td>
<td>Leadership and Management Development</td>
</tr>
<tr>
<td>T-WIWI-107043</td>
<td>Liberalised Power Markets</td>
</tr>
<tr>
<td>T-ETIT-100772</td>
<td>Lighting Engineering</td>
</tr>
<tr>
<td>T-ETIT-105221</td>
<td>Lightweight Engineering Design</td>
</tr>
<tr>
<td>T-CIIVVT-111095</td>
<td>Liquid Transportation Fuels</td>
</tr>
<tr>
<td>T-INFO-101377</td>
<td>Localization of Mobile Agents</td>
</tr>
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<td>Logistics and Supply Chain Management</td>
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<td>T-MACH-105232</td>
<td>Machines and Processes, Prerequisite</td>
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<td>Magnet Technology of Fusion Reactors</td>
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<td>Magnetohydrodynamics</td>
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<td>3.240. Mathematical Models and Methods for Production Systems</td>
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<td>3.257. Micro Magnetic Resonance</td>
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<td>3.260. Microstructure-Property-Relationships</td>
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<td>3.261. Microsystem Simulation</td>
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<td>3.263. Modeling and Simulation</td>
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<td>3.265. Modeling of Turbulent Flows - RANS and LES</td>
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<td>3.268. Modern Control Concepts I</td>
<td>T-MACH-105539</td>
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<td>3.269. Motor Vehicle Labor</td>
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<td>3.271. Neutron Physics of Fusion Reactors</td>
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<td>3.281. Numerical Simulation of Multi-Phase Flows</td>
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<td>3.283. Organ Support Systems</td>
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<td>3.286. Photovoltaics</td>
<td>T-ETIT-101939</td>
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</table>
3.290. Plastic Electronics / Polymerelectronics - T-ETIT-100763 ......................................................... 427
3.291. Plasticity of Metals and Intermetallics - T-MACH-110818 .......................................................... 428
3.292. Polymer Engineering I - T-MACH-102137 ..................................................................................... 430
3.293. Polymer Engineering II - T-MACH-102138 ................................................................................ 431
3.295. Polymers in MEMS B: Physics, Microstructuring and Applications - T-MACH-102191 ............ 434
3.296. Polymers in MEMS C: Biopolymers and Bioplastics - T-MACH-102200 ................................. 435
3.298. Practical Course Combustion Technology - T-CIWVT-108873 ................................................. 438
3.299. Practical Course Technical Ceramics - T-MACH-105178 .......................................................... 439
3.300. Practical Training in Basics of Microsystem Technology - T-MACH-102164 ......................... 440
3.301. Practical Training in Measurement of Vibrations - T-MACH-105373 ........................................ 442
3.303. Principles of Medicine for Engineers - T-MACH-105235 ............................................................ 444
3.305. Process Simulation in Forming Operations - T-MACH-105348 ................................................. 446
3.308. Product Development - Dimensioning of Components - T-MACH-105383 ............................ 450
3.309. Product Lifecycle Management - T-MACH-105147 ................................................................. 451
3.310. Product, Process and Resource Integration in the Automotive Industry - T-MACH-102155 ...... 452
3.311. Production Operations Management - T-MACH-110327 .......................................................... 453
3.312. Production Operations Management-Project - T-MACH-110326 .......................................... 454
3.313. Production Planning and Control - T-MACH-105470 ............................................................... 455
3.314. Production Techniques Laboratory - T-MACH-105346 ............................................................ 456
3.315. Productivity Management in Production Systems - T-MACH-105523 .................................... 458
3.316. Project Report Water Distribution Systems - T-BGU-108485 .................................................. 459
3.317. Project work - T-MACH-110106 ............................................................................................... 460
3.318. Project Workshop: Automotive Engineering - T-MACH-102156 ............................................. 461
3.319. Python Algorithm for Vehicle Technology - T-MACH-110796 ............................................... 463
3.320. Quality Management - T-MACH-102107 .................................................................................. 465
3.321. Rail System Technology - T-MACH-106424 .............................................................................. 467
3.322. Rail Vehicle Technology - T-MACH-105353 ............................................................................. 469
3.323. Railways in the Transportation Market - T-MACH-105540 ....................................................... 471
3.326. Reliability Engineering 1 - T-MACH-107447 ............................................................................ 476
3.328. Robotics I - Introduction to Robotics - T-INFO-108014 ............................................................ 479
3.329. Robotics II - Humanoid Robotics - T-INFO-105723 ............................................................... 480
3.331. Safety Engineering - T-MACH-105171 ....................................................................................... 482
3.332. Scaling in Fluid Dynamics - T-MACH-105400 ........................................................................ 483
3.333. Selected Chapters of the Combustion Fundamentals - T-MACH-105428 ............................... 484
3.335. Self-Booking-MSc-HOC-SPZ-ZAK-Graduated - T-MACH-111687 .................................... 486
3.337. Seminar in Materials Science - T-MACH-100290 ................................................................. 488
3.340. Simulation of Coupled Systems - T-MACH-105172 ................................................................. 491
3.341. Simulation of Coupled Systems - Advance - T-MACH-108888 .............................................. 493
3.342. Simulator Exercises Combined Cycle Power Plants - T-MACH-105445 ................................. 494
3.343. Smoothed Particle Hydrodynamics (SPH) in Computational Fluid Dynamics - T-MACH-111396 495
3.344. Solar Energy - T-ETIT-100774 ................................................................................................. 496
3.348. Strategic Product Development - Identification of Potentials of Innovative Products - Case Study - T-MACH-110396 502
<table>
<thead>
<tr>
<th>Module Code</th>
<th>Title</th>
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<td>T-MACH-105970</td>
<td>Structural Analysis of Composite Laminates</td>
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<td>Systematic Materials Selection</td>
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<td>Systems Engineering for Automotive Electronics</td>
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<td>Technical Design in Product Development</td>
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<td>Technical Energy Systems for Buildings 2: System Concept</td>
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<td>T-MACH-105362</td>
<td>Technology of Steel Components</td>
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<td>Ten Lectures on Turbulence</td>
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<td>Theory of Probability</td>
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<td>Two-Phase Flow and Heat Transfer</td>
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<td>Vehicle Lightweight Design - Strategies, Concepts, Materials</td>
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<td>Vehicle Ride Comfort &amp; Acoustics I</td>
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<td>Vehicle Systems for Urban Mobility</td>
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<td>Virtual Engineering (Specific Topics)</td>
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<td>Virtual Reality Practical Course</td>
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<td>3.411. Windpower - T-MACH-105234</td>
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<td>3.412. Working Methods in Materials Science and Technology - T-MACH-100288</td>
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<td>3.413. Workshop Mechatronical Systems and Products - T-MACH-108680</td>
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1 Field of study structure

### Mandatory

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**Note regarding usage**
First usage possible from 4/1/2023.

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

Bricks should be chosen according to the Learning Agreement.

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### 1.2 Courses of Other KIT Departments and Interdisciplinary Qualifications

**Note regarding usage**
First usage possible from 4/1/2023.

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<td>M-MACH-106255 Key Competences</td>
<td>6 CR</td>
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# 2 Modules

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

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Courses of Other KIT Departments and Interdisciplinary Qualifications

<table>
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<tr>
<th>Credits</th>
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**Election notes**
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

**Exchange Students_ARCH (Election: at most 90 credits)**

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

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

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

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

**Content**
See individual bricks
2.2 Module: Courses of the KIT Department of Chemical and Process Engineering [M-MACH-105100]

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>30</td>
<td>pass/fail</td>
<td>Each term</td>
<td>1 term</td>
<td>German/English</td>
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Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Exchange Students_CIW (Electon: between 0 and 90 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>CR</th>
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<tbody>
<tr>
<td>T-CIWVT-108915</td>
<td>Cryogenic Engineering</td>
<td>6 CR Grohmann</td>
</tr>
<tr>
<td>T-CIWVT-110571</td>
<td>Design of a Jet Engine Combustion Chamber</td>
<td>6 CR Harth</td>
</tr>
<tr>
<td>T-CIWVT-110576</td>
<td>Energy from Biomass</td>
<td>6 CR Bajohr, Dahmen</td>
</tr>
<tr>
<td>T-CIWVT-111095</td>
<td>Liquid Transportation Fuels</td>
<td>6 CR Rauch</td>
</tr>
<tr>
<td>T-CIWVT-108873</td>
<td>Practical Course Combustion Technology</td>
<td>4 CR Harth</td>
</tr>
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</table>

Competence Certificate
Oral exams: duration approx. 5 min per credit point
Written exams: duration approx. 20 - 25 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

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

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

Content
See brick courses

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

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Each term</td>
<td>2 terms</td>
<td>German/English</td>
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Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Exchange Students_Chembio (Electio: at most 90 credits)

<table>
<thead>
<tr>
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<th>Title</th>
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<tr>
<td>T-CHEMBIO-112316</td>
<td>Batteries and Fuel Cells</td>
<td>4 CR</td>
<td>Ehrenberg</td>
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<tr>
<td>T-CHEMBIO-112317</td>
<td>Hydrogen as Energy Carrier</td>
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<td>T-MACH-112698</td>
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Competence Certificate

Oral exams: duration approx. 5 min per credit point
Written exams: duration approx. 20 - 25 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

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

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

Content
See individual bricks
**Module: Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences [M-MACH-105405]**

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>30</td>
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<td>Each term</td>
<td>1 term</td>
<td>German/English</td>
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**Credits 30, Grading scale pass/fail, Recurrence Each term, Duration 1 term, Language German/English, Level 4, Version 2**

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

**Exchange Students_BGU (Election: )**

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<td>T-BGU-100039</td>
<td>Applied Building Physics</td>
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<tr>
<td>T-BGU-110841</td>
<td>Fluid Mechanics of Turbulent Flows</td>
<td>6</td>
<td>Uhlmann</td>
</tr>
<tr>
<td>T-BGU-109953</td>
<td>Fundamental Numerical Algorithms for Engineers</td>
<td>3</td>
<td>Uhlmann</td>
</tr>
<tr>
<td>T-BGU-100040</td>
<td>Building Technology</td>
<td>3</td>
<td>Wirth</td>
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<tr>
<td>T-BGU-100047</td>
<td>Basics of Finite Elements</td>
<td>3</td>
<td>Betsch</td>
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<td>Homework 'Basics of Finite Elements'</td>
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<td>Betsch</td>
</tr>
<tr>
<td>T-BGU-110842</td>
<td>Modeling of Turbulent Flows - RANS and LES</td>
<td>6</td>
<td>Uhlmann</td>
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<tr>
<td>T-BGU-108485</td>
<td>Project Report Water Distribution Systems</td>
<td>2</td>
<td>Oberle</td>
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<tr>
<td>T-BGU-108486</td>
<td>Water Distribution Systems</td>
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<td>Oberle</td>
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**Competence Certificate**
Type and duration of the exam/ success control can vary according to the individually choice and is described in more detail within the individual brick.

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

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

**Content**
See individual bricks
2.5 Module: Courses of the KIT Department of Economics and Management [M-MACH-104884]

**Responsible:** Prof. Dr.-Ing. Martin Heilmayer  
Prof. Dr.-Ing. Carsten Proppe

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Courses of Other KIT Departments and Interdisciplinary Qualifications

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

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

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<th>Exchange Students WIWI (Elect: between 0 and 90 credits)</th>
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<tbody>
<tr>
<td>T-WIWI-102758 Introduction to Operations Research I and II</td>
<td>9 CR Nickel, Rebennack, Stein</td>
</tr>
<tr>
<td>T-WIWI-107501 Energy Market Engineering</td>
<td>4,5 CR Weinhardt</td>
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<tr>
<td>T-WIWI-102864 Entrepreneurship</td>
<td>3 CR Terzidis</td>
</tr>
<tr>
<td>T-WIWI-102900 Financial Analysis</td>
<td>4,5 CR Luedecke</td>
</tr>
<tr>
<td>T-WIWI-107043 Liberalised Power Markets</td>
<td>5,5 CR Fichtner</td>
</tr>
<tr>
<td>T-WIWI-102870 Logistics and Supply Chain Management</td>
<td>3,5 CR Schultmann</td>
</tr>
<tr>
<td>T-WIWI-102800 Management Accounting 1</td>
<td>4,5 CR Wouters</td>
</tr>
<tr>
<td>T-WIWI-109864 Product and Innovation Management</td>
<td>3 CR Klarmann</td>
</tr>
<tr>
<td>T-WIWI-102629 Management and Strategy</td>
<td>3,5 CR Lindstädt</td>
</tr>
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</table>

**Competence Certificate**  
Oral exams: duration approx. 5 min per credit point  
Written exams: duration approx. 20 - 25 min per credit point  
Amount, type and scope of the success control can vary according to the individually choice.

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

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

**Content**  
See individual bricks
2.6 Module: Courses of the KIT Department of Electrical Engineering and Information Technology [M-MACH-104882]

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

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
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<td>pass/fail</td>
<td>Each term</td>
<td>2 terms</td>
<td>German/English</td>
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</table>

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

**Exchange Students ETIT (Election: between 0 and 90 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>T-ETIT-101956</td>
<td>Bioelectric Signals</td>
<td>3 CR</td>
<td>Loewe</td>
</tr>
<tr>
<td>T-ETIT-106492</td>
<td>Biomedical Measurement Techniques I</td>
<td>3 CR</td>
<td>Nahm</td>
</tr>
<tr>
<td>T-ETIT-101918</td>
<td>Digital Technology</td>
<td>6 CR</td>
<td>Becker</td>
</tr>
<tr>
<td>T-ETIT-103608</td>
<td>Electric Power Generation and Power Grid</td>
<td>3 CR</td>
<td>Hoferer</td>
</tr>
<tr>
<td>T-ETIT-110883</td>
<td>Electric Power Transmission &amp; Grid Control</td>
<td>4 CR</td>
<td>Leibfried</td>
</tr>
<tr>
<td>T-ETIT-101954</td>
<td>Electrical Machines and Power Electronics</td>
<td>6 CR</td>
<td>Hiller</td>
</tr>
<tr>
<td>T-ETIT-101923</td>
<td>Electric Energy Systems</td>
<td>5 CR</td>
<td>Leibfried</td>
</tr>
<tr>
<td>T-ETIT-109318</td>
<td>Electronic Devices and Circuits</td>
<td>6 CR</td>
<td>Ulusoy</td>
</tr>
<tr>
<td>T-ETIT-108386</td>
<td>Electrical Engineering and Electronics</td>
<td>8 CR</td>
<td>De Carne</td>
</tr>
<tr>
<td>T-ETIT-109820</td>
<td>Electrical Engineering and Electronics</td>
<td>8 CR</td>
<td>Doppelbauer</td>
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<tr>
<td>T-ETIT-104644</td>
<td>Energy Storage and Network Integration</td>
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<td>Noe</td>
</tr>
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<td>T-ETIT-100784</td>
<td>Hybrid and Electric Vehicles</td>
<td>4 CR</td>
<td>Doppelbauer</td>
</tr>
<tr>
<td>T-ETIT-100772</td>
<td>Lighting Engineering</td>
<td>4 CR</td>
<td>Neumann</td>
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<td>T-ETIT-113048</td>
<td>Medical Imaging Technology I</td>
<td>3 CR</td>
<td>Spadea</td>
</tr>
<tr>
<td>T-ETIT-113421</td>
<td>Medical Imaging Technology II</td>
<td>3 CR</td>
<td>Spadea</td>
</tr>
<tr>
<td>T-ETIT-106964</td>
<td>Methods of Signal Processing</td>
<td>6 CR</td>
<td>Heizmann</td>
</tr>
<tr>
<td>T-ETIT-101939</td>
<td>Photovoltaics</td>
<td>6 CR</td>
<td>Powalla</td>
</tr>
<tr>
<td>T-ETIT-100763</td>
<td>Plastic Electronics / Polymerelectronics</td>
<td>3 CR</td>
<td>Lemmer</td>
</tr>
<tr>
<td>T-ETIT-104686</td>
<td>Laboratory Solar Energy</td>
<td>6 CR</td>
<td>Trampert</td>
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<td>T-ETIT-100716</td>
<td>Industrial Circuity</td>
<td>3 CR</td>
<td>Liske</td>
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<tr>
<td>T-ETIT-101911</td>
<td>Sensors</td>
<td>3 CR</td>
<td>Menesklou</td>
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<td>T-ETIT-100774</td>
<td>Solar Energy</td>
<td>6 CR</td>
<td>Richards</td>
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<td>T-ETIT-110788</td>
<td>Superconductors for Energy Applications</td>
<td>5 CR</td>
<td>Grilli</td>
</tr>
<tr>
<td>T-ETIT-101921</td>
<td>System Dynamics and Control Engineering</td>
<td>6 CR</td>
<td>Hohmann</td>
</tr>
<tr>
<td>T-ETIT-100677</td>
<td>Systems Engineering for Automotive Electronics</td>
<td>4 CR</td>
<td>Bortolazzi</td>
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<tr>
<td>T-ETIT-101952</td>
<td>Theory of Probability</td>
<td>5 CR</td>
<td>Jäkel</td>
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</table>

**Competence Certificate**

Oral exams: duration approx. 5 min per credit point  
Written exams: duration approx. 20 - 25 min per credit point  
Amount, type and scope of the success control can vary according to the individually choice.

**Prerequisites**

Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.
**Competence Goal**
The students are able to reconstruct selected topics of Electrical Engineering and Information Technology.

**Content**
See individual bricks
Module: Courses of the KIT Department of Humanities and Social Sciences [M-MACH-106253]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
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<td>Each term</td>
<td>2 terms</td>
<td>German/English</td>
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Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

<table>
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<tr>
<th>Exchange Students_GeistSoz (Election: at most 90 credits)</th>
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<tbody>
<tr>
<td>T-MACH-112700 Wildcard</td>
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<td>T-MACH-112701 Wildcard</td>
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Competence Certificate
Oral exams: duration approx. 5 min per credit point
Written exams: duration approx. 20 - 25 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

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

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

Content
See individual bricks
2.8 Module: Courses of the KIT Department of Informatics [M-MACH-104883]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
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<td>pass/fail</td>
<td>Each term</td>
<td>2 terms</td>
<td>German/English</td>
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Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Exchange Students_INFO (Elective: between 0 and 90 credits)

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>T-INFO-101466</td>
<td>Information Processing in Sensor Networks</td>
<td>6</td>
<td>Hanebeck</td>
</tr>
<tr>
<td>T-INFO-101377</td>
<td>Localization of Mobile Agents</td>
<td>6</td>
<td>Hanebeck</td>
</tr>
<tr>
<td>T-INFO-101294</td>
<td>Mechano-Informatics and Robotics</td>
<td>4</td>
<td>Asfour</td>
</tr>
<tr>
<td>T-INFO-101266</td>
<td>Human-Machine-Interaction</td>
<td>6</td>
<td>Beigl</td>
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<tr>
<td>T-INFO-101310</td>
<td>Patent Law</td>
<td>3</td>
<td>Werner</td>
</tr>
<tr>
<td>T-INFO-108014</td>
<td>Robotics I - Introduction to Robotics</td>
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<td>T-INFO-105723</td>
<td>Robotics II - Humanoid Robotics</td>
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<td>Asfour</td>
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<tr>
<td>T-INFO-109931</td>
<td>Robotics III - Sensors and Perception in Robotics</td>
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<td>Asfour</td>
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Competence Certificate
Oral exams: duration approx. 5 min per credit point
Written exams: duration approx. 20 - 25 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

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

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

Content
See individual bricks
Module: Courses of the KIT Department of Mathematics [M-MACH-104885]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other KIT Departments and Interdisciplinary Qualifications

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

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

<table>
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<tr>
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<td>T-MATH-108269</td>
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<td>T-MATH-108270</td>
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<tr>
<td>T-MATH-102242</td>
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Competence Certificate
Oral exams: duration approx. 5 min per credit point
Written exams: duration approx. 20 - 25 min per credit point
Amount, type and scope of the success control can vary according to the individually choice.

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

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

Content
See individual bricks
## 2.10 Module: Courses of the KIT Department of Mechanical Engineering [M-MACH-106250]

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

### Organisation:
KIT Department of Mechanical Engineering

### Part of:
Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Credits</th>
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### KIT Department of Mechanical Engineering Courses (Election: )

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

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Courses of Other KIT Departments and Interdisciplinary Qualifications

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

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

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

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

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

**Content**
See individual bricks
2.12 Module: Key Competences [M-MACH-106255]

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

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Courses of Other KIT Departments and Interdisciplinary Qualifications

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**Election notes**

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

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

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**Competence Certificate**

Success is monitored within the framework of academic achievements.

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

**Prerequisites**

none

**Competence Goal**

After completing the module Key Competences students can

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

**Content**

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

**Module grade calculation**

Certification without grade

**Annotation**

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

**Learning type**

lectures, seminars, tutorials, lab courses.
### 2.13 Module: Project [M-MACH-104840]

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
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<tr>
<td>30</td>
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<td>Each term</td>
<td>1 term</td>
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**Project (Election: at most 1 item)**

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<tr>
<th>Module Code</th>
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<th>Grading</th>
<th>Level</th>
<th>Supervisor</th>
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<tr>
<td>T-MACH-109880</td>
<td>Thesis (MSc)</td>
<td>30 CR</td>
<td>Heilmaier</td>
<td></td>
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<tr>
<td>T-MACH-110107</td>
<td>Thesis (BSc)</td>
<td>15 CR</td>
<td>Heilmaier</td>
<td></td>
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<tr>
<td>T-MACH-110106</td>
<td>Project work</td>
<td>20 CR</td>
<td>Heilmaier</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Competence Certificate**

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

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Workload**

Maximum: 900 hours.
### 3.1 Course: Actuators and Sensors in Nanotechnology [T-MACH-105238]

**Responsible:** Prof. Dr. Manfred Kohl  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24 2141866</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>1</td>
</tr>
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</table>

**Exams**

<table>
<thead>
<tr>
<th>Exam Code</th>
<th>Type</th>
<th>Course Title</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24 76-T-MACH-105238</td>
<td>Lecture / 🧩</td>
<td>Actuators and Sensors in Nanotechnology</td>
<td>Kohl, Sommer</td>
</tr>
<tr>
<td>ST 2024 76-T-MACH-105238</td>
<td>Lecture (V)</td>
<td>Actuators and Sensors in Nanotechnology</td>
<td>Kohl, Sommer</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**

oral exam

**Prerequisites**

none

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

**Actuators and sensors in nanotechnology**

2141866, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)  

Lecture (V)  

Blended (On-Site/Online)
T 3.2 Course: Advanced Mathematics III [T-MATH-108270]

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

**Organisation:** KIT Department of Mathematics

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
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<td>Each term</td>
<td>1</td>
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</table>

**Events**

| Events | Code   | Code
|--------|--------|-----------------
| WT 23/24 | 0160000 | Advanced Mathematics III (Lecture)
|        |        | 4 SWS Lecture Nitsche |

**Exams**

| Events | Code   | Code
|--------|--------|-----------------
| WT 23/24 | 7700116 | Advanced Mathematics III
|        |        | Nitsche, Sorcar, Link |

**Competence Certificate**

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

**Prerequisites**

Passing scores for homework are prerequisites for the examination.

**Modeled Conditions**

The following conditions have to be fulfilled:

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

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

**Organisation:** KIT Department of Mathematics

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Grading scale</th>
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<th>Practice</th>
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<td>Advanced Mathematics III (Tutorial)</td>
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<td>Nitsche</td>
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**Exams**

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<th>Course Title</th>
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<tr>
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<td>7700068</td>
<td>Advanced Mathematics III Prerequisite</td>
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</table>

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

**Prerequisites**
None.
3.4 Course: Airport Logistics [T-MACH-105175]

**Responsible:** Dr.-Ing. André Richter  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Grading scale</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Exams**

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<th>Grading scale</th>
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<th>Version</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

**Airport logistics**  
2117056, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Content**

**Media**

Presentations

**Learning content**

- Introduction  
- Airport installations  
- Luggage transport  
- Passenger transport  
- Security on the airport  
- Legal bases of the air traffic  
- Freight on the airport

**Learning goals**
The students are able to:

- Describe material handling and informations technology activities on airports,  
- Evaluate processes and systems on airports as the law stands, and  
- Choose appropriate processes and material handling systems for airports.

**Recommendations**
None

**Workload**

Regular attendance: 21 hours  
Self-study: 99 hours

**Note**

Limited number of participants: allocation of places in sequence of registration (first come first served). Registration via "ILIAS" mandatory.  
Personal presence during lectures mandatory.

**Organizational issues**

Termine: siehe ILIAS.
Literature
3.5 Course: Alternative Powertrain for Automobiles [T-MACH-105655]

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

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

<table>
<thead>
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**Events**

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<th>2133132</th>
<th>Sustainable Vehicle Drivetrains</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Toedter</th>
</tr>
</thead>
</table>

**Exams**

| WT 23/24 | 76-T-MACH-105655 | Sustainable Vehicle Drivetrains | Toedter |

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

**Competence Certificate**

written exam

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

**V Sustainable Vehicle Drivetrains**

2133132, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

Sustainability  
Environmental balance  
Legislation  
Alternative fuels  
BEV  
Fuel cell  
Hybrid drives
3.6 Course: Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines
[T-MACH-105173]

**Responsible:** Dr.-Ing. Marcus Gohl

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>1</td>
</tr>
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</table>

**Events**

| ST 2024 | 2134150 | Gas, lubricating oil and operating media analysis in drive train development | 2 SWS | Lecture / Gohl |

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

**Competence Certificate**

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

**Prerequisites**

none

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

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

2134150, SS 2024, 2 SWS, Language: German, Open in study portal

**Literature**

Die Vorlesungsunterlagen werden vor jeder Veranstaltung an die Studenten verteilt.
3.7 Course: Analysis Tools for Combustion Diagnostics [T-MACH-105167]

**Responsible:** Jürgen Pfeil  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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<table>
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<tr>
<th>Events</th>
<th>Credits</th>
<th>Type</th>
<th>Lecturer</th>
<th>Language</th>
<th>Prerequisites</th>
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<tr>
<td>ST 2024</td>
<td>2 SWS</td>
<td>Analysis tools for combustion diagnostics</td>
<td>Pfeil</td>
<td>Open in study portal</td>
<td>none</td>
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<table>
<thead>
<tr>
<th>Exams</th>
<th>Credits</th>
<th>Type</th>
<th>Lecturer</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td></td>
<td>Analysis Tools for Combustion Diagnostics</td>
<td>Koch</td>
<td></td>
</tr>
</tbody>
</table>

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

**Prerequisites**  
none

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

**Analysis tools for combustion diagnostics**  
2134134, SS 2024, 2 SWS, Language: German, Open in study portal

**Literature**  
Skript, erhältlich in der Vorlesung
3.8 Course: Applied Building Physics [T-BGU-100039]

**Responsible:** N.N.

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

**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

<table>
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<td>Each term</td>
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**Events**

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<th>SWS</th>
<th>Type</th>
<th>Instructor(s)</th>
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<tr>
<td>WT 23/24</td>
<td>6211909</td>
<td>Angewandte Bauphysik</td>
<td>2</td>
<td>Lecture/🗣</td>
<td>Vogel, Dehn, Altmann</td>
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**Exams**

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<thead>
<tr>
<th>Term</th>
<th>Code</th>
<th>Course Name</th>
<th>Type</th>
<th>Instructor(s)</th>
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<td>Applied Building Physics</td>
<td></td>
<td>Dehn</td>
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**Legend:** 🖥 Online, ☢ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
3.9 Course: Applied Materials Simulation [T-MACH-105527]

**Responsible:** Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<th>Version</th>
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<td>Each summer term</td>
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**Events**

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<tr>
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<th>Code</th>
<th>Course</th>
<th>Credits</th>
<th>Type</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2024</td>
<td>2182614</td>
<td>Applied Materials Simulation</td>
<td>4</td>
<td>SWS</td>
<td>Lecture / Practice (VÜ)</td>
</tr>
</tbody>
</table>

**Competence Certificate**
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 Conditions**
The following conditions have to be fulfilled:

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

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

**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 wir nur als Aufzeichnung angeboten!
Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (2182616)!
Weitere Informationen finden Sie in ILIAS.
Kontakt: johannes.schneider@kit.edu

Literature
3.10 Course: Applied Mathematics in Natural Science: Flows with chemical reactions [T-MACH-108847]

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

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

<table>
<thead>
<tr>
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<th>Recurrence</th>
<th>Version</th>
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<td>Each winter term</td>
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Events

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<th>WT 23/24</th>
<th>2153406</th>
<th>Flows with chemical reactions</th>
<th>2 SWS</th>
<th>Lecture / Blended (On-Site/Online)</th>
<th>Class</th>
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Exams

<table>
<thead>
<tr>
<th>WT 23/24</th>
<th>76-T-MACH-105422</th>
<th>Flows with Chemical Reactions</th>
<th>Class</th>
</tr>
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</table>

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

Competence Certificate
The study performance is considered to have been passed if all exercise assignments have been successfully processed and the final colloquium (30 minutes) has been successfully passed.
no auxiliary mean

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)
Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

Flows with chemical reactions
2153406, WS 23/24, 2 SWS, Language: German/English, Open in study portal

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

Content
The students can describe flow scenarios, where a chemical reaction is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficient numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaction is confined to a thin layer. The problems are solved analytically or they are at least simplified allowing for efficient numerical solution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

Literature
Vorlesungsskript

Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983
### 3.11 Course: Applied Tribology in Industrial Product Development [T-MACH-105215]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
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<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>2</td>
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</table>

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

**Prerequisites**  
None
3.12 Course: Atomistic Simulations and Particle Dynamics [T-MACH-113412]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<tbody>
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<td>4</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Competence Certificate**
oral exam ca. 30 minutes

**Prerequisites**
none

**Recommendation**
preliminary knowledge in mathematics, physics and materials science
### 3.13 Course: Automated Manufacturing Systems [T-MACH-108844]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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<td>Automated Manufacturing Systems</td>
<td>Lecture / Practice (/)</td>
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**Competence Certificate**

oral exam (40 minutes)

**Prerequisites**

"T-MACH-102162 - Automatisierte Produktionsanlagen" must not be commenced.

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

**Automated Manufacturing Systems**

2150904, SS 2024, 6 SWS, Language: German, Open in study portal  
Lecture / Practice (VÜ)  
On-Site

---

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled
**Content**
The lecture gives an overview of the structure and functioning of automated production plants. In a basic chapter, fundamental elements for the realisation of automated production systems are taught. These include:

- Drive and control technology
- Handling technology for handling workpieces and tools
- Industrial robot technology
- Quality assurance in automated production plants
- Automated machines, cells, centres and systems for production and assembly
- Structures of multi-machine systems
- Project planning of automated production plants

An interdisciplinary view of these sub-areas results in interfaces to Industry 4.0 approaches. The basic chapters are supplemented by practical application examples and live demonstrations in the Karlsruhe Forschungsfabrik.

In the second part of the lecture, the fundamentals taught will be clarified using practically executed production processes for manufacturing and disassembling components, and the automated production facilities for manufacturing these components will be analyzed. In the field of automotive powertrain technology, the automated production process for both the manufacture and disassembly of batteries is considered. In the powertrain area, automated production facilities for the disassembly of electric motors are considered. Furthermore, automated production systems for the field of additive manufacturing are considered.

Within tutorials, the contents from the lecture are deepened and applied to concrete problems and tasks.

**Learning Outcomes:**

The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

**Workload:**

**MACH:**
- regular attendance: 63 hours
- self-study: 177 hours

**WING:**
- regular attendance: 63 hours
- self-study: 207 hours

**Organizational issues**

Vorlesungsstermine dienstags 8:00 Uhr und donnerstags 8:00 Uhr, Übungstermine donnerstags 09:45 Uhr.

Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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/).
3.14 Course: Automated Production Systems (MEI) [T-MACH-106732]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Each summer term</td>
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**Events**

| ST 2024 | 3150012 | Automated Production Systems (MEI) | 2 SWS | Lecture / 🧩 | Fleischer |

**Exams**

| WT 23/24 | 76-T-MACH-106732 | Automated Production Systems (MEI) |  | Fleischer |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗿 On-Site, ✗ Cancelled

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

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

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

1. The course T-MACH-108844 - Automated Manufacturing Systems must not have been started.

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

**Automated Production Systems (MEI)**
3150012, SS 2024, 2 SWS, Language: English, Open in study portal  
Lecture (V) Blended (On-Site/Online)

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

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

In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components. The analysis of automated manufacturing systems for manufacturing of defined components is also included.

**Learning Outcomes:**
The students …

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

**Organizational issues**
Die genauen Termine und Raum werden über die wbk-Homepage bekannt gegeben.
### 3.15 Course: Automotive Engineering I [T-MACH-100092]

**Responsible:** Prof. Dr. Frank Gauterin  
Dr.-Ing. Martin Gießler  

**Organisation:** KIT Department of Mechanical Engineering  

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

#### Type
- **Written examination**
- **Credits:** 8  
- **Grading scale:** Grade to a third  
- **Recurrence:** Each winter term  
- **Expansion:** 1 terms  
- **Language:**  
- **Version:** 3

#### Events

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<td>4 SWS</td>
<td>Automotive Engineering I</td>
<td>Gauterin, Gießler</td>
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<td>WT 23/24</td>
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<td>4 SWS</td>
<td>Automotive Engineering I</td>
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#### Exams

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<td>Unrau, Gauterin</td>
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<td>76-T-MACH-100092</td>
<td>Automotive Engineering</td>
<td>Gauterin, Gießler</td>
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#### Competence Certificate

**Written examination**  
Duration: 120 minutes  
Auxiliary means: none

#### Prerequisites

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

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

#### Automotive Engineering I

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<tr>
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<tbody>
<tr>
<td>2113805</td>
<td>4 SWS</td>
<td>Open in study portal</td>
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</table>

**Content**

1. History and future of the automobile  
2. Driving mechanics: driving resistances and driving performance, mechanics of longitudinal and lateral forces, active and passive safety  
3. Drive systems: combustion engine, hybrid and electric drive systems  
4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)  
5. Power transmission and distribution: drive shafts, cardon joints, differentials

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

**Organizational issues**

Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter [https://fast-web-01.fast.kit.edu/Passwoerterilias/](https://fast-web-01.fast.kit.edu/Passwoerterilias/)

Kann nicht mit der Veranstaltung [2113809] kombiniert werden.

Can not be combined with lecture [2113809].
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, cardan joints, differentials

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

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

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

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

Literature
3.16 Course: Automotive Engineering II [T-MACH-102117]

**Responsible:** Prof. Dr. Frank Gauterin  
Dr.-Ing. Martin Gießler

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

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**Competence Certificate**

Written Examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**

none

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

### Automotive Engineering II

2114835, SS 2024, 2 SWS, Language: German, Open in study portal

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

**Content**

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

**Learning Objectives:**

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

### Organizational issues

Kann nicht mit der Veranstaltung [2114855] kombiniert werden.  
Can not be combined with lecture [2114855]
Literature


Automotive Engineering II
2114855, SS 2024, 2 SWS, Language: English, Open in study portal

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

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

Literature
Elective literature:
3.17 Course: Automotive Vision [T-MACH-105218]

**Responsible:** Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**

Type of Examination: written exam
Duration of Examination: 60 minutes

**Prerequisites**

none

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

**Automotive Vision**

2138340, SS 2024, 3 SWS, Language: English, Open in study portal

**Content**

**Lernziele (EN):**

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

**Lehrinhalt (EN):**

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

Nachweis: Written examination 60 minutes

Arbeitsaufwand (EN): 120 hours

**Literature**

Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.
3.18 Course: Basics in Measurement and Control Systems [T-MACH-104745]

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

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

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**Exams**

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

**Competence Certificate**

written exam  
2,5 hours

**Prerequisites**

none

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

**Measurement and Control Systems**  
2137301, WS 23/24, 3 SWS, Language: German, Open in study portal
Content
Lehrinhalt (EN):
1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and stability
4 Controller design
5 Fundamentals of measurement
6 Estimation
7 Sensors
8 Introduction to digital measurement

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

Voraussetzungen (EN)
Fundamentals in physics and electrical engineering; ordinary linear differential equations; Laplace transform

Nachweis (EN)
written exam; duration 2.5 h; paper reference materials only (no calculator)

Arbeitsaufwand (EN):
210 hours

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

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

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

• Messtechnische Bücher:
E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980
Content
Lehrinhalt (EN):
1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and modeling
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. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley

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

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

Measurement and Control Systems (Tutorial)
3137021, WS 23/24, 1 SWS, Language: English, Open in study portal

Content
Tutorial for Measurement and Control Systems
### 3.19 Course: Basics of Finite Elements [T-BGU-100047]

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

<table>
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<td>Übungen zu Grundlagen Finite Elemente</td>
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<td>2</td>
<td>Lecture</td>
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</tbody>
</table>

**Legend:**  
- 🖥 Online  
- ⛳️ Blended (On-Site/Online)  
- 🗣 On-Site  
- ✗ Cancelled

**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
3.20 Course: Basics of Manufacturing Technology (MEI) [T-MACH-108747]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Legend:** 🤔 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⏰ Cancelled

**Competence Certificate**

written exam (duration: 60 min)

**Prerequisites**

none

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

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<td>3118092, WS 23/24, 2 SWS, Language: English</td>
<td>Lecture (V)</td>
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</table>
Content
The objective of the lecture is to classify the manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to establish basic process knowledge of the common processes. The lecture conveys the basic principles of manufacturing technology and deals with the manufacturing processes based on example components according to their classification into main groups regarding technical and economic aspects. Regard is paid to classic manufacturing processes as well as new developments like additive manufacturing processes.

The following topics will be covered:

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

Learning Outcomes:
The students ...

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

Workload:
regular attendance: 21 hours
self-study: 99 hours

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

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

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).
3.21 Course: Basics of Technical Logistics I [T-MACH-109919]

Responsible: Dr.-Ing. Martin Mittwollen
Dr.-Ing. Jan Oellerich

Organisation: KIT Department of Mechanical Engineering

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

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Exams

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Legend: 🖥 Online, 📦 Blended (On-Site/Online), 🟠 On-Site, ✘ Cancelled

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

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics preconditioned.

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

Basics of Technical Logistics I
2117095, WS 23/24, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ) On-Site

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

Students are able to:
- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines
- Model real machines applying knowledge from lessons and calculate their dimensions.
Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen oder mündlichen Prüfung (nach §4 (2), 1 bzw. 2SPO).
The assessment consists of a written or oral exam according to Section 4 (2), 1 or 2 of the examination regulation.
Es wird Kenntnis der Grundlagen der Technischen Mechanik vorausgesetzt.
Basics knowledge of technical mechanics is preconditioned.
Ergänzungsblätter, Präsentationen, Tafel.
Supplementary sheets, presentations, blackboard.
Präsenz: 48Std
Nacharbeit: 132Std
presence: 48h
rework: 132h

Literature
Empfehlungen in der Vorlesung / Recommendations during lessons
### 3.22 Course: Basics of Technical Logistics II [T-MACH-109920]

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

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

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled

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

**Prerequisites**  
none

**Recommendation**  
Knowledge of the basics of technical mechanics and out of "Basic of Technical Logistics I" (T-MACH-109919) preconditioned.
### 3.23 Course: Batteries and Fuel Cells [T-CHEMBIO-112316]

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

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**Exams**

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**Legend:**  
- 🖥 Online  
- 🧩 Blended (On-Site/Online)  
- 🗣 On-Site  
- ❌ Cancelled

**Competence Certificate**

Oral exam, about 25 minutes
Course: Behaviour Generation for Vehicles [T-MACH-105367]

Responsible: Maximilian Naumann
Moritz Werling

Organisation: KIT Department of Mechanical Engineering

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

Type: Written examination
Credits: 6
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 2

**Events**

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**Exams**

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**Competence Certificate**
written examination
60 min.
Simple calculators are allowed, programmable or graphical ones are prohibited.

**Prerequisites**
none

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

**Behaviour Generation for Vehicles**
2138336, WS 23/24, 3 SWS, Language: German, Open in study portal
Course: Behaviour Generation for Vehicles [T-MACH-105367]

Content

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

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

Contents:

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

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

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

Nachweis: written exam
Arbeitsaufwand: 180 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Diese Folien sowie Beispielprogramme werden über ILIAS bereitgestellt bzw. verlinkt. Es wird empfohlen, falls vorhanden, ein eigenes Notebook mitzunehmen, da viele direkt ausführbare Programmbeispiele die Vorlesung begleiten.
### 3.25 Course: Bioelectric Signals [T-ETIT-101956]

**Responsible:** Dr.-Ing. Axel Loewe  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Events**

| ST 2024 | 2305264 | Bioelectric Signals | 2 SWS | Lecture / 🗣 | Loewe |

**Exams**

| ST 2024 | 7305264 | Bioelectric Signals | Loewe |

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

**Competence Certificate**

The examination is a written examination with a duration of 90 minutes.

**Prerequisites**

none
### 3.26 Course: Biomedical Measurement Techniques I [T-ETIT-106492]

**Responsible:** Prof. Dr. Werner Nahm  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Events**

| WT 23/24  | 2305269 | Biomedical Measurement Techniques I | 2 SWS | Lecture / 🧩 | Nahm, Schaufelberger |

**Exams**

| WT 23/24  | 7305269 | Biomedical Measurement Techniques I | Nahm |

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

**Prerequisites**
The earlier version "T-ETIT-101928 - Biomedizinische Messtechnik I" may not have been started or completed.
3.27 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I [T-MACH-100966]

**Responsible:** Prof. Dr. Andreas Guber

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Exams**

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<td>Lecture</td>
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<td>Guber</td>
<td>76-T-MACH-100966</td>
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**Competence Certificate**

written exam (75 Min.)

**Prerequisites**

none

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

**Organizational issues**

schriftliche Prüfung:
18.03.2024, 10:00 - 12:00; 30.46 Chemie, Neuer 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
3.28 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

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

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

<table>
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<td></td>
<td></td>
<td>Guber, Ahrens</td>
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</table>

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

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

BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II
2142883, SS 2024, 2 SWS, Language: German, Open in study portal

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.
Prüfung:

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

**Responsible:** Prof. Dr. Andreas Guber

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

| ST 2024 | 2142879 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 2 SWS | Lecture / 🗣 | Guber, Ahrens |

**Exams**

| WT 23/24 | 76-T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | Guber |

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

**Competence Certificate**
Written exam (75 Min.)

**Prerequisites**
none

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

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

2142879, SS 2024, 2 SWS, Language: German, Open in study portal

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

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

**Prüfung:**

**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
3.30 Course: Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning [T-MACH-113359]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Exams

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</table>

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

Competence Certificate
Oral exam, approximately 30 minutes

Prerequisites
Students successfully passed courses on fluid dynamics and thermodynamics.

Recommendation
- Profound knowledge on thermodynamics and fluid mechanics is mandatory.
- Machine and processes lecture (LVNr. 3134140) is highly recommended before taking this course.
- The course requires basic knowledge in engineering mathematics and computer programming at an undergraduate level. Basic knowledge in python is strongly recommended.
- We expect students to be interested in applying theoretical knowledge and translate it into real world experiments.

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

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

Boosting the Modern Energy Landscape via Turbo Machines & Machine Learning lecture (V)
2169558, WS 23/24, 2 SWS, Language: English, Open in study portal
Content
This lecture provides a comprehensive exploration of how small radial flow turbo machines contribute to the modern energy landscape. A typical application of such machines is pressurized fuel cells used as drive train for cars and trucks. From understanding the thermodynamics and flow characteristics of centrifugal compressors and centripetal turbines to practical experiments and the integration of machine learning techniques, students will gain a holistic understanding of the potential of turbo machines for energy conversion efficiency, emissions reduction, and performance optimization. The lecture further provides a hands-on sample application of machine learning, with a specific focus on its pivotal role in developing digital twins that utilize sensory data.

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

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

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

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

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

pon completing this lecture, students will:

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

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

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

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

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

Literature
- gitlab.kit.edu/cihan.ates/data-driven-engineering
### 3.31 Course: Building Technology [T-BGU-100040]

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

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**Exams**

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

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

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
3.32 Course: Business Administration for Engineers and IT Professionals [T-MACH-109933]

**Responsible:** Heinz-Peter Sebregondi

**Organisation:** KIT Department of Mechanical Engineering

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

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<td>Seminar / 🗣️</td>
<td>Sebregondi</td>
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**Competition Certificate**

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

**Prerequisites**

None

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

### Business Administration for Engineers and IT professionals

**2122303, WS 23/24, 2 SWS, Language: German/English, Open in study portal**

**Seminar (S) On-Site**

**Content**

**Learning content**

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

**Learning objectives**

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

**Organizational issues**

Teilnehmerzahl ist auf 12 Personen begrenzt. / Number of participants limited to 12 people.

**Literature**

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

Understanding a company’s business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)
Business Administration for Engineers and IT Professionals
2122303, SS 2024, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
Learning content

- Competitive strategies, customer value, corporate cultures, lifecycles (technology, business, product), market leadership dynamics.
- Continuum commoditization/differentiation.
- Value chain, core and support functions.
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Learning objectives

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- use the language and metrics of senior executives and hold effective conversations with them
- more effectively sell a solution's or project's operational and financial value to executives and decision makers

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

Literature
Understanding a company's business and financials made easy; Heinz-Peter Sebregondi (Amazon 2017)
Erfolgsfaktoren für die nachhaltige Business-Karriere: Die menschliche und die Business-Perspektive; Heinz-Peter Sebregondi (Amazon 2018)
3.33 Course: CAD-NX Training Course [T-MACH-102187]

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

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

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

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

**Prerequisites**  
None

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

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

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

**CAD-NX training course**  
2123357, WS 23/24, 2 SWS, Language: German, [Open in study portal]  
**Practical course (P)**  
Blended (On-Site/Online)

**Content**

- Overview of the functional range
- Introduction to the work environment of NX
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

**Organizational issues**

Das Praktikum kann entweder vorlesungsbegleitend oder als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit absolviert werden. Weitere Informationen siehe ILIAS.

**Literature**  
Praktikumsskript
CAD-NX training course
2123357, SS 2024, 2 SWS, Language: German/English, Open in study portal

Content

- Overview of the functional range
- Introduction to the work environment of NX
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

Organizational issues
Informationen zum Ablauf des Praktikums werden in einer Auftaktveranstaltung veröffentlicht. Hinweise hierzu siehe ILIAS.

Literature
Praktikumsskript
3.34 Course: CAE-Workshop [T-MACH-105212]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

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

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

**Competence Certificate**
Written test (with practical part on the computer), duration 60 min.

**Prerequisites**
None

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

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

**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.
CAE-Workshop
2147175, SS 2024, 3 SWS, Language: German, Open in study portal

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.
3 COURSES

Course: CATIA Advanced [T-MACH-105312]

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

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

<table>
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Exams

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

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

Prerequisites
none

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

Advanced CATIA

2123380, WS 23/24, 3 SWS, Language: German/English, Open in study portal

Project (PRO)
Blended (On-Site/Online)

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Organizational issues
Siehe ILIAS zur Lehrveranstaltung

Literature
Keine / None

CATIA advanced

2123380, SS 2024, 3 SWS, Language: German/English, Open in study portal

Project (PRO)
Blended (On-Site/Online)

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Organizational issues
Siehe ILIAS-Kurs.

Literature
Keine / None
3.36 Course: CATIA CAD Training Course [T-MACH-102185]

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

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

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Legend: ▻ Online, ☭ Blended (On-Site/Online), ● On-Site, x Cancelled

Competence Certificate

Practical examination on CAD computer, duration: 60 min.

Prerequisites

None

Recommendation

Dealing with technical drawings is required.

Annotation

For the practical course attendance is compulsory.

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

CATIA CAD training course
2123358, WS 23/24, 2 SWS, Language: German, Open in study portal
Practical course (P) Blended (On-Site/Online)

Content

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

Students are able to:

- create their own 3D geometric models in the CAD system CATIA and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of CATIA to automate the creation of geometry and thus to ensure the reusability of the models.

Organizational issues

Das Praktikum kann vorlesungsbegleitend absolviert werden oder als einwöchige Blockveranstaltung in der vorlesungsfreien Zeit. Weitere Informationen siehe ILIAS.

Literature

Praktikumskript
CATIA CAD training course
2123358, SS 2024, 2 SWS, Language: German/English, Open in study portal

Content

- Basics of CATIA such as user interface, handling etc.
- Production and processing of different model types
- Production of basic geometries and parts
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Organizational issues
Informationen zum Ablauf des Praktikums werden in einer Auftaktveranstaltung veröffentlicht. Hinweise hierzu siehe ILIAS.

Literature
Praktikumskript
3.37 Course: CFD for Power Engineering [T-MACH-105407]

**Responsible:** Dr. Ivan Otic  
**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

| ST 2024 | 2130910 | CFD for Power Engineering | 2 SWS | Lecture / 🧩 | Otic |

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

**Competence Certificate**

Oral exam, 30 min

**Prerequisites**

none

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

**CFD for Power Engineering**

2130910, SS 2024, 2 SWS, Language: English, [Open in study portal](#)
Content

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

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.

Content
1. Introduction: What is Computational Fluid Dynamics?
2. Governing Equations
3. Numerical Methods: Introduction
4. Numerical Methods: Finite Volume
5. Numerical Methods: Solution of ordinary differential equations
6. Numerical Methods: Convergence and numerical stability
7. Turbulence and Turbulence Modelling
8. Reynolds Averaged Navier-Stokes Simulation Approach
9. Heat Transfer

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

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

Literature
Vorlesungsskript
Projektskript und Unterlagen
### 3.38 Course: CFD-Lab Using OpenFOAM [T-MACH-105313]

**Responsible:** Dr.-Ing. Rainer Koch

**Organisation:** KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

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

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**Exams**

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**Legend:**

- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

**Competence Certificate**

Successful solution of problems

**Prerequisites**

none

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

**CFD-Lab using OpenFOAM**

2169459, WS 23/24, 3 SWS, Language: German, [Open in study portal](#)

**Practical course (P)**

**On-Site**

**Content**

- Successful solution of problems
- Course material is distributed on ILIAS
- Introduction to using Open Foam
- Grid generation
- Boundary conditions
- Numerical errors
- Discretization schemes
- Turbulence models
- Two phase flow - Euler-Lagrange
- Large Eddy Simulation
- Combustion

The students are able to:

- use OpenFOAM
- generate simple grids or import grids into OpenFOAM
- choose and define appropriate boundary conditions
- estimate numerical errors and assess them
- judge turbulence models and select an appropriate model
- simulate 2-phase flows using suitable models

**Organizational issues**

**Literature**

- Dokumentation zu OpenFOAM
- [https://openfoam.org/](https://openfoam.org/)
3.39 Course: Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies [T-MACH-102169]

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

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

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

Prerequisites
none
# 3.40 Course: Coal Fired Power Plants [T-MACH-105410]

- **Responsible:** Hon.-Prof. Dr. Thomas Schulenberg
- **Organisation:** KIT Department of Mechanical Engineering

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

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### Competence Certificate
Oral examination, Duration approximately 30 Minutes
no tools or reference materials may be used during the exam

### Prerequisites
none
### 3.41 Course: Cognitive Automobiles - Laboratory [T-MACH-105378]

**Responsible:** Bernd Kitt  
Dr. Martin Lauer  
Prof. Dr.-Ing. Christoph Stiller  

**Organisation:** KIT Department of Mechanical Engineering  

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

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**Events**

| ST 2024 | 2138341 | Cognitive Automobiles - Laboratory | 3 SWS | / 🗣 | Stiller, Lauer, Blumberg |

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

**Competence Certificate**  
oral exam  
30 minutes  

**Prerequisites**  
none  

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

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

**Content**

**Lehrinhalt (EN):**
1. Lane recognition  
2. Object detection  
3. Vehicle lateral control  
4. Vehicle longitudinal control  
5. Collision avoidance

**Lernziele (EN):**  
The laboratory accompanies the lectures "Automotive Vision" and "Behaviour Generation for Vehicles". It will provide the opportunity of turning theoretical skills taught in the lecture to practice. The laboratory is divided into four groups with a maximum number of five students in each group. During the lessons you will be supervised by scientific staff. 

The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on "seeing vehicles". Each group is given the task to extract lane markings from video images and generate a suitable trajectory which the vehicle should follow. Apart from technical aspects in a highly innovative field of automotive technology, participants have the opportunity of gathering important qualifications as i.e. implementation skills, acquisition and comprehension of suitable literature, project and team work.  

**Nachweis:** Colloquia, final race  

**Arbeitsaufwand:** 120 hours  

**Literature**  
Dokumentation zur SW und HW werden als pdf bereitgestellt.
3.42 Course: Combined Cycle Power Plants [T-MACH-105444]

**Responsible:** Hon.-Prof. Dr. Thomas Schulenberg
**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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**Competence Certificate**
oral exam ca. 30 min

**Prerequisites**
none

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

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

**Combined Cycle Power Plants**
2170490, SS 2024, 2 SWS, Language: English, Open in study portal

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

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

**Literature**
Die gezeigten Vorlesungsfolien und weiteres Unterrichtsmaterial werden bereitgestellt.
Ferner empfohlen:
3.43 Course: Combustion Engines I [T-MACH-102194]

**Responsible:** Prof. Dr. Thomas Koch  
Dr.-Ing. Heiko Kubach

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

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

**Prerequisites**
none

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

**Content**
Introduction, Presentation of IFKM
Working Principle
Characteristic Parameters
Engine Parts
Drive Train
Fuels
Gasoline Engines
Diesel Engines
Hydrogen Engines
Exhaust Gas Emissions

**Organizational issues**
Übungstermine Donnerstags nach Bekanntgabe in der Vorlesung
### 3.44 Course: Combustion Engines II [T-MACH-104609]

**Responsible:** Dr.-Ing. Rainer Koch  
Dr.-Ing. Heiko Kubach  

**Organisation:** KIT Department of Mechanical Engineering  

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

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#### Events

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<td>Kubach, Koch</td>
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**Legend:**  
🖥 Online  
🧩 Blended (On-Site/Online)  
🗣 On-Site  
🗙 Cancelled

**Competence Certificate**  
oral examination, duration: 25 minutes, no auxiliary means

**Prerequisites**  
none

**Recommendation**  
Fundamentals of Combustion Engines I helpful

---

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

**CO2-neutral combustion engines and their fuels II**  
2134151, SS 2024, 3 SWS, Language: German, [Open in study portal](#)  
Lecture / Practice (VÜ)  
On-Site
3.45 Course: Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies [T-MACH-105535]

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

**Lightweight Design**

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

<table>
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**Events**

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<td>2114053</td>
<td>Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</td>
<td>2 SWS</td>
<td>Lecture / 🧩 Henning</td>
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<td>Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</td>
<td>Henning</td>
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<td>ST 2024</td>
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<td>Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</td>
<td>Henning</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗹 On-Site, ❌ Cancelled

**Competence Certificate**

written exam 90 minutes

**Prerequisites**

none

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

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

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<td>2 SWS, German</td>
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</table>
Content

Physical connections of fiber reinforcement

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

Resins
- Thermoplastics
- Duromeres

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

Semi-finished products - textiles

Process technologies - prepregs

Recycling of composites

Aim of this lecture:
Students know different polymer resin materials and fiber materials and can deduce their character and use.
They understand the reinforcing effect of fibers in a matrix surrounding as well as the tasks of the single components in a compound. They know about the influence of the length of fibers, their mechanical characters and performance in a polymer matrix compound.
Student know the important industrial production processes for continuous and discontinuous reinforced polymer matrix compounds.

Organizational issues
Die Lehrveranstaltung wird im SS 2024 als Hybridveranstaltung geplant.

Literature

Literatur Leichtbau II

[1-7]
Course: Computational Dynamics [T-MACH-105349]

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

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

<table>
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Events

WT 23/24: Computational Dynamics, 2 SWS, Lecture / Online, Proppe
ST 2024: Computational Dynamics, 2 SWS, Lecture / On-Site, Proppe

Exams

WT 23/24: 76-T-MACH-105349, Computational Dynamics, Proppe
ST 2024: 76-T-MACH-105349, Computational Dynamics, Proppe

Competence Certificate
oral exam, duration approx. 20 min.

Prerequisites
none

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

Computational Dynamics
2162246, WS 23/24, 2 SWS, Language: German, Open in study portal

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

Literature
1. Ein Vorlesungsskript wird bereitgestellt!

Computational Dynamics
2162246, SS 2024, 2 SWS, Language: German, Open in study portal

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

Literature
1. Ein Vorlesungsskript wird bereitgestellt!
### Course: Computational Intelligence [T-MACH-105314]

**Responsible:** Stefan Meisenbacher  
apl. Prof. Dr. Ralf Mikut  
apl. Prof. Dr. Markus Reischl

**Organisation:** KIT Department of Mechanical Engineering

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

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<table>
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**Events**

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**Exams**

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<td>Mikut</td>
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**Competence Certificate**

Written exam (Duration: 1h)

**Prerequisites**

none

---

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

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### Content

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

**Content:**

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

**Learning objectives:**

The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms, deep learning) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.
Literature
Kroll, A. Computational Intelligence: Eine Einführung in Probleme, Methoden und technische Anwendungen Oldenbourg Verlag, 2013
Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe; 2008 (PDF frei im Internet)
# 3.48 Course: Computational Mechanics I [T-MACH-105351]

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

**Organisation:** KIT Department of Mechanical Engineering  

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

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**Events**

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<td>2</td>
<td>Lecture</td>
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<td>Langhoff, Böhlke</td>
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**Competence Certificate**  
oral examination, 30 min.

**Prerequisites**  
none

**Recommendation**  
The contents of the lectures "Mathematical Methods in Continuum Mechanics" and "Introduction to the Finite Element Method" are assumed to be known  
This course is geared to MSc students of Mechanical Engineering

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

**Computational Mechanics I**

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**Literature**

3.49 Course: Computational Mechanics II [T-MACH-105352]

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

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Oral examination

**Credits**  
6

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
2

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### Events

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<td>Computational Mechanics II</td>
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<td>Grade to a third</td>
<td>Each summer term</td>
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<td>Böhlke, Langhoff</td>
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<td>Krause, Keursten, Böhlke</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled

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

**Prerequisites**  
none

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

#### Lecture (V)

**Computational Mechanics II**  
2162296, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

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

**Literature**  

---

#### Practice (Ü)

**Tutorial Computational Mechanics II**  
2162297, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Content**  
see lecture "Computational Mechanics II"

**Organizational issues**  
weitere Informationen siehe Homepage bzw in der ersten Vorlesung

**Literature**  
siehe Vorlesung "Rechnerunterstützte Mechanik II"
3.50 Course: Computational Vehicle Dynamics [T-MACH-105350]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Events

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Exams

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<tr>
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<td>Computational Vehicle Dynamics</td>
<td>Proppe</td>
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</table>

Legend: 🕵️‍♂️ Online, 🕵️ Blended (On-Site/Online), 🗺️ On-Site, ✗ Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

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

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

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

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

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

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

Literature
3.51 Course: Computer Science for Engineers [T-MACH-105205]

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

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

<table>
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**Events**

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<td>Lecture / Practice</td>
<td>Elstermann, Meyer</td>
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<td>ST 2024</td>
<td>3121034</td>
<td>Computer Science for Engineers</td>
<td>4</td>
<td>Lecture / Practice</td>
<td>Elstermann, Meyer</td>
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**Exams**

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<td>Computer Science for Engineers</td>
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**Exams Responsible:** Ovtcharova, Elstermann, Meyer

**Prerequisites**

Computer Science for Engineers, passed

**Modeled Conditions**

The following conditions have to be fulfilled:

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

**Competence Certificate**

Written exam [180 min]

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

### Computer Science for Engineers

**2121390, SS 2024, 4 SWS, Language: German, Open in study portal**

**Lecture / Practice (VÜ)**

**Content**

Basics: Information representation- and processing, terms and definitions: alphabet, data, signals, information, numeral systems, propositional logic and Boolean algebra, computer architectures, programming paradigms.

Object Orientation: Definition and important characteristics of object orientation, Object-oriented modeling with UML.

Data Structures: Definition, properties and application of graphs, trees, linked lists, queues and stacks.

Algorithms: Characteristics of algorithms, complexity analysis, design methods, important examples.

Database management systems: Relational data model, relational algebra, declarative language SQL.

**Organizational issues**

Computer Science for Engineers
3121034, SS 2024, 4 SWS, Language: English, Open in study portal

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

Literature
„Grundkurs Programmieren in Java“ Carl Hanser Verlag GmbH & CO. KG; Auflage 6, ISBN 10: 3446426639
3.52 Course: Computer Science for Engineers, Prerequisite [T-MACH-105206]

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

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

<table>
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<td>ST 2024 3121036 Computer Science for Engineers Lab Course</td>
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<td>/ 📚</td>
<td>Elstermann, Meyer, Mitarbeiter</td>
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**Exams**  
ST 2024 76-T-MACH-105206 Computer Science for Engineers, Prerequisite  
Meyer, Elstermann

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

**Prerequisites**  
none

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

**Computer Lab for Computer Science in Mechanical Engineering**  
2121392, SS 2024, 2 SWS, Language: German, Open in study portal  
On-Site

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

**Organizational issues**  
Wenn Poolräume nutzbar, dann Poolräume

**Literature**  
Übungsblätter / exercise sheets

**Computer Science for Engineers Lab Course**  
3121036, SS 2024, 2 SWS, Language: English, Open in study portal  
Online

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

**Organizational issues**  
Wenn Präsenz möglich, dann ID-Raum Nutzung

**Literature**  
Exercise sheets / Übungsblätter
3.53 Course: Computerized Multibody Dynamics [T-MACH-105384]

**Responsible:** Felix Boy  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering  

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

| WT 23/24 | 2162216 | Computerized Multibody Dynamics | 2 SWS | Lecture | Boy |

**Competence Certificate**

Oral exam, 30 min.

**Prerequisites**

None

**Recommendation**

Knowledge of EM III/IV

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

**Computerized Multibody Dynamics**  
2162216, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Organizational issues**

Die Vorlesung wird im WS 23/24 nicht angeboten.

**Literature**

AUTOLEV: User Manual
3.54 Course: Constitution and Properties of Protective Coatings [T-MACH-105150]

**Responsible:** Prof. Sven Ulrich

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Each winter term</td>
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**Events**

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**Exams**

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</table>

**Competence Certificate**

oral examination (about 30 min)

no tools or reference materials

**Prerequisites**

none

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

### Content

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

Teaching Content:

- introduction and overview
- concepts of surface modification
- coating concepts
- coating materials
- methods of surface modification
- coating methods
- characterization methods
- state of the art of industrial coating of tools and components
- new developments of coating technology
- regular attendance: 22 hours
- self-study: 98 hours

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

**Recommendations:** none

**Organizational issues**

Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 23.10.23. Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 25.10.23.
Literature

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed
### Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

**Responsible:** Prof. Sven Ulrich  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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#### Events

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<td>Constitution and Properties of Wear resistant materials</td>
<td>Ulrich</td>
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</table>

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

**Competence Certificate**

oral examination (about 30 min)

no tools or reference materials

**Prerequisites**

none

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

**Constitution and Properties of Wear resistant materials**

2194643, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V) On-Site**

**Content**

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

Teaching Content:

introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellite and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

regular attendance: 22 hours

self-study: 98 hours

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

Recommendations: none
Organizational issues
Die Blockveranstaltung findet in folgendem Zeitraum statt:
15.04.-17.04.2024: jeweils von 8:00-16:00 Uhr;
Ort: KIT-CN, Geb. 681, Raum 214
Anmeldung verbindlich bis zum 13.04.2024 unter sven.ulrich@kit.edu.
Nach der Anmeldung wird Ihnen im Falle einer Online-Veranstaltung der Link zur Vorlesung per E-Mail am 14.04.2024 mitgeteilt.

Literature
Schneider, J.: Schneidkeramik, Verlag moderne Industrie, Landsberg am Lech, 1995
Kopien der Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed
3.56 Course: Contact Mechanics [T-MACH-105786]

Responsible: Prof. Dr. Christian Greiner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowledge in mathematics, physics and materials science

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

Contact Mechanics
2181220, SS 2024, 2 SWS, Language: German, Open in study portal

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

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

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

preliminary knowledge in mathematics, physics and materials science recommended
regular attendance: 22.5 hours
self-study: 97.5 hours
oral exam ca. 30 minutes

Literature
K. L. Johnson, Contact Mechanics (Cambridge University Press, 1985)
D. Maugis, Contact, Adhesion and Rupture of Elastic Solids (Springer-Verlag, 2000)
Course: Continuum Mechanics of Solids and Fluids [T-MACH-110377]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
Prof. Dr.-Ing. Bettina Frohnapfel

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Written examination

**Credits**  
3

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Expansion**  
1 terms

**Version**  
5

**Events**

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</table>

**Competence Certificate**

Written examination (90 min). Additives as announced

**Prerequisites**

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

**Modeled Conditions**

The following conditions have to be fulfilled:

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

**Annotation**

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) and students of the bachelor's degree program in material science and material technology will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

**Continuum mechanics of solids and fluids**

2161252, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Content**

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

**Literature**

Vorlesungsskript

Schade, H.: Strömungslehre, de Gruyter 2013
Course: Control of Mobile Machines [T-MACH-111821]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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

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

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

1. The course T-MACH-111820 - Control of Mobile Machines – Prerequisites must have been passed.
### 3.59 Course: Control of Mobile Machines – Prerequisites [T-MACH-111820]

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

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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**Competence Certificate**  
Preparation of a report on the completion of the semester task

**Prerequisites**  
none
### Course: Control Technology [T-MACH-105185]

**Responsible:** Hon.-Prof. Dr. Christoph Gönnheimer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Control Technology</td>
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<td>Gönnheimer</td>
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</table>

**Competence Certificate**  
Written Exam (60 min)

**Prerequisites**  
none

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

#### Lecture (V)

**Control Technology**  
2150683, SS 2024, 2 SWS, Language: German, Open in study portal

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

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

Learning Outcomes:
The students ...

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

Workload:
regular attendance: 21 hours
self-study: 99 hours

Organizational issues
Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik (https://www.karlsruher-forschungsfabrik.de) unterstützt. The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory (https://www.karlsruher-forschungsfabrik.de/en.html) to deepen the acquired knowledge.

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

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).
3.61 Course: Cryogenic Engineering [T-CIWVT-108915]

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

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<td>Practice</td>
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**Exams**

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</table>

**Legend:** 🖥 Online, 🕰 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

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

**Prerequisites**

None
3.62 Course: Data Analytics for Engineers [T-MACH-105694]

**Responsible:** Stefan Meisenbacher  
apl. Prof. Dr. Ralf Mikut  
apl. Prof. Dr. Markus Reischl

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Exams**

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<td>Datenanalyse für Ingenieure</td>
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<td>Mikut, Reischl</td>
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</table>

**Competence Certificate**

Written exam (Duration: 1h)

**Prerequisites**

none

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

**Data Analytics for Engineers**  
2106014, SS 2024, 3 SWS, Language: German, Open in study portal

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

**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)
3.63 Course: Design and Development of Mobile Machines [T-MACH-105311]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

**Organisation:** KIT Department of Mechanical Engineering

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

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**
--- | --- | --- | --- | ---
Oral examination | 4 | Grade to a third | Each winter term | 1

**Events**

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<th>2 SWS</th>
<th>Lecture</th>
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**Exams**

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Legend: 🖥 Online, 🔄 Blended (On-Site/Online), 🗹 On-Site, ✗ Canceled

**Competence Certificate**

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

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

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

**Prerequisites**

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

**Modeled Conditions**

The following conditions have to be fulfilled:

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

**Recommendation**

Knowledge in Fluid Power Systems (LV 2114093)

**Annotation**

After completion of the lecture, students can:

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

The number of participants is limited.

**Conent:**

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

**Literature:**

See german recommendations

*Below you will find excerpts from events related to this course:*
Content
Wheel loaders and excavators are highly specialized mobile machines. Their function is to detach, pick up and deposit materials near by. Significant size for dimensioning of the machines is the content of their standard shovel. In this lecture the main steps in dimensioning a wheel loader or excavator are being thought. This includes among others:

- Defining the size and dimensions,
- the dimensioning of the electric drive train,
- the dimensioning of the primary energy supply,
- Determining the kinematics of the equipment,
- the dimension of the working hydraulics and
- Calculations of strength

The entire design process of these machines is strongly influenced by the use of standards and guidelines (ISO/DIN-EN). Even this aspect is dealt with.

The lecture is based on the knowledge from the fields of mechanics, strength of materials, machine elements, propulsion and fluid technique. The lecture requires active participation and continued collaboration.

Recommendations:
Knowledge in Fluid Technology (SoSe, LV 21093)

- regular attendance: 21 hours
- self-study: 99 hours

Literature
Keine.
3.64 Course: Design and Development of Mobile Machines - Advance [T-MACH-108887]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

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

<table>
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Exams
WT 23/24 76-T-MACH-108887 Design and Development of Mobile Machines - Advance Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none
3.65 Course: Design and Optimization of Conventional and Electrified Automotive Transmissions [T-MACH-110958]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Hartmut Faust

Organisation: KIT Department of Mechanical Engineering

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

<table>
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<td>Each summer term</td>
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Events

| ST 2024 | 2146208 | Design and Optimization of Conventional and Electrified Automotive Transmissions | 2 SWS | Lecture / 🗣️ | Faust |

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

Competence Certificate
oral exam (20 min)

Prerequisites
none

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

Design and Optimization of Conventional and Electrified Automotive Transmissions

2146208, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site

Content

- Transmission types: Manual (MT) & automated manual transmissions (AMT), planetary torque converter machines (AT), double clutch (DCT), continuously variable (CVT) and geared neutral transmissions (IVT), hybrid transmissions (serial, parallel, multimode, Powersplit hybrid), E-axes
- Torsional vibration damper: damped clutch disc, dual mass flywheel, centrifugal pendulum (FKP), lock-up damper for torque converter
- Starting elements: dry single clutch, dry and wet double clutch, hydrodynamic torque converter, special shapes, e-motor
- Power transmission: countershaft transmission, planetary gear set, CVT variator, chain, synchronization, shift and claw clutches, reversing, differentials and locking systems, coaxial and axially parallel E-axis drives
- Transmission control: shift systems for MT, actuators for clutches and gear shifting, hydraulic control, electronic control, software application, comfort and sportiness
- Special designs: drive trains of commercial vehicles, hydrostat with power split, torque vectoring
- E-mobility: Classification into 5 stages of electrification, 4 hybrid configurations, 7 parallel hybrid architectures, hybridized transmissions (P2, P2.5, P3, P4), dedicated hybrid transmissions (DHT: serial / parallel / multimode, powersplit, new ones Concepts), gearbox for electric vehicles (E-axle gearbox, coaxial and axially parallel)

Organizational issues


Lernziele

Die Studenten erwerben das Wissen aus aktuellen Getriebe-, Hybrid- und reinen Elektroantriebs-Entwicklungen über …

- die Funktionsweise und Auslegung von konventionellen und elektrifizierten Fahrzeuggetrieben und deren Komponenten;
- Konstruktions- und Funktionsprinzipien der wichtigsten Komponenten von Handschalt-, Doppelkupplungs-, stufenlosen und Planetenautomat-Gebrauch; 
- komfortrelevante Zusammenhänge und Abhilfemaßnahmen; 
- die Hybridisierung und Elektrifizierung der Triebstränge auf Basis bekannter Getriebetypen und mit speziellen sogenannten Dedicated Hybrid Transmissions (DHT) sowie Bewertung der Konzepte auf Systemebene.
# 3.66 Course: Design of a Jet Engine Combustion Chamber [T-CIWVT-110571]

**Responsible:** Dr.-Ing. Stefan Raphael Harth  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

<table>
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## Events

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## Exams

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

## Competence Certificate
Success control is an examination of another kind according to § 4 Abs. 2 Nr. 3 SPO.

## Project
Participation and presentation as well as a final oral examination amounting to max. 30 minutes.

## Prerequisites
None
### Course: Design of Highly Stresses Components [T-MACH-105310]

**Responsible:** apl. Prof. Dr. Jarir Aktaa  
**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

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<tr>
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</table>

**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 31.10.2023 statt

**Literature**

3.68 Course: Design with Plastics [T-MACH-105330]

**Responsible:** Dipl.-Ing. Markus Liedel  
**Organisation:** KIT Department of Mechanical Engineering

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

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

**Competence Certificate**  
Oral exam, about 20 minutes

**Prerequisites**  
none

**Recommendation**  
Poly I

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

**Design with Plastics**  
2174571, SS 2024, 2 SWS, Language: German, [Open in study portal](#)
Content
Structure and properties of plastics materials,
Processing of plastics,
Behavior of plastics under environmental impacts,
Classic strength dimensioning,
Geometric dimensioning,
Plastic appropriate design,
Failure examples,
Joining of plastic parts,
Supporting simulation tools,
Structural foams,
Plastics Technology trends.

learning objectives:
Students will be able to
• distinguish polymer compounds from other construction materials regarding chemical differences, thermal behavior and solid conditions.
• discuss main plastics processes regarding advantages and disadvantages of materials selection and part geometry design and to make appropriate selections.
• analyze complex application requirements concerning material impacts on strength and to use the classic dimensioning method specific to the application to evaluate the lifetime part strength limit.
• evaluate part tolerances and geometry by appropriate methods considering molding shrinkage, production tolerances, post shrinkage, heat expansion, swelling, elastic and creep deformation.
• design plastic specific joining geometries like snap fits, screw bosses, weld seams and film hinges.
• detect classic molding failures and understand potential causes as well as to reduce the probability of molding failures by defining an optimized design.
• understand benefits and limits of selected simulation tools in the plastic technology discipline (strength, deformation, filling, warpage).
• assess polymer classes and plastic part designs with respect to suitable recycling concepts and ecological consequences.

requirements:
none,

recommendation: Polymerengineering I

workload:
The workload for the lecture Design with Plastics is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Organizational issues
Anmeldung unter Markus.Liedel@de.bosch.com

Literature
Materialien werden in der Vorlesung ausgegeben.
Literaturhinweise werden in der Vorlesung gegeben.
3.69 Course: Designing with Composites [T-MACH-108721]

**Responsible:** Prof. Dr. Eckart Schnack

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Competence Certificate**
Oral exam, 20 minutes

**Prerequisites**
None

**Annotation**
The lecture notes are made available via ILIAS.
3.70 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Responsible: Dr.-Ing. Isabelle Ays  
Dr.-Ing. Gerhard Geerling  

Organisation: KIT Department of Mechanical Engineering  

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

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Events

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Exams

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Legend: 🖥 Online, 📌 Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled

Competence Certificate
oral exam (20 min)

Prerequisites
none

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

Development of Oil-Hydraulic Powertrain Systems
2113072, WS 23/24, 2 SWS, Language: German, Open in study portal

Content
The block course offered by the Chair of Mobile Machines (Mobima) conveys the basics of planning and development of mobile and industrial hydrostatic systems. The lecturer works for a market leading company producing fluid power drives and controls and gives a deep view into the process of planning and development using real life examples. The contents of the course are:

- marketing, project planning
- hydrostatic circuits
- heat balance, hydraulic accumulators
- filtration, noise lowering
- development exercises + laboratory tutorial

knowledge in the fluidics

- regular attendance: 19 hours
- self-study: 90 hours

Organizational issues
siehe Homepage
3 COURSES
Course: Differential Equations - Exam [T-MATH-103323]

3.71 Course: Differential Equations - Exam [T-MATH-103323]

**Responsible:** PD Dr. Volker Grimm  
Prof. Dr. Marlis Hochbruck  
PD Dr. Markus Neher

**Organisation:** KIT Department of Mathematics

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

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| WT 23/24 0132300        | Ü    | 1 SWS   |              |            |         | Grimm       |
| Exercises to Advanced Mathematics III for the Functional Direction Civil Engineering: Differential equations | | | | |

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<thead>
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<th>Type</th>
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<td>Advanced Mathematics 3 for the Functional Direction Civil Engineering: Differential Equations - Exam</td>
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Legend: 🖥 Online, 💐 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

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

**V** Advanced Mathematics III for the Functional Direction Civil Engineering: Differential equations  
0132200, WS 23/24, 2 SWS, Language: German, Open in study portal  
Lecture (V) On-Site

**V** Exercises to Advanced Mathematics III for the Functional Direction Civil Engineering: Differential equations  
0132300, WS 23/24, 1 SWS, Language: German, Open in study portal  
Practice (Ü) On-Site
**T 3.72 Course: Digital Control [T-MACH-105317]**

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

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

<table>
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**Exams**

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**Competence Certificate**

written exam  
60 min.

**Prerequisites**

none

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

**V Digital Control**  
2137309, WS 23/24, 2 SWS, Language: German, Open in study portal

**Lecture (V) On-Site**

**Content**

**Lehrinhalt (EN):**

1. Introduction into digital control: Motivation for digital implementation of controllers  
   Structure of digital feedback control loops  
   Sample and hold units

2. State space analysis and design:  
   Discretisation of continuous-time systems  
   Discrete-time state space equations  
   Stability - definition and criteria  
   State feedback design by eigenvalue assignment  
   PI state feedback controller Luenberger observer, separation theorem  
   Systems with dead-time  
   Deadbeat design

3. Analysis and design based on z-transform:  
   z-transform - definition and theorems  
   Control loop description in the z domain  
   Stability criteria  
   Root locus controller design  
   Transfer of continuous-time controllers into discrete-time controllers

**Voraussetzungen (EN):**

Basic studies and preliminary examination; basic lectures in automatic control

**Lernziele (EN):**

The lecture introduces key methods for the analysis and design of digital feedback control systems.  
Starting point is the discretisation of linear, continuous-time models.  
State space based and z-transform based controller design techniques are presented for discrete-time, single-input single-output systems.  
Furthermore, plants with dead-time and deadbeat design are covered.

**Nachweis:** oral examination; duration: 30 minutes

**Arbeitsaufwand:** 120 hours

**Literature**

3.73 Course: Digital Technology [T-ETIT-101918]

**Responsible:** Prof. Dr.-Ing. Jürgen Becker  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Exams**

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**Prerequisites**

none

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled
### 3.74 Course: Digitization in the Railway System [T-MACH-113016]

**Responsible:** Prof. Dr.-Ing. Martin Cichon  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Legend:**  
🖥 Online,  
🧩 Blended (On-Site/Online),  
🗣 On-Site,  
🗙 Cancelled

**Competence Certificate**  
Oral examination  
Duration: approx. 20 minutes  
No tools or reference material may be used during the exam.
3.75 Course: Drive Systems and Possibilities to Increase Efficiency [T-MACH-105451]

Responsible: Dr.-Ing. Hans-Peter Kollmeier
Organisation: KIT Department of Mechanical Engineering

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

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

Prerequisites
none
3.76 Course: Drive Train of Mobile Machines [T-MACH-105307]

Responsible: Prof. Dr.-Ing. Marcus Geimer
              Marco Wydra

Organisation: KIT Department of Mechanical Engineering

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

<table>
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Events

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<td>Drive Train of Mobile Machines</td>
<td>Lecture / 🗣️</td>
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Exams

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Competence Certificate

The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in every semester and can be repeated at any regular examination date.

Prerequisites

none

Recommendation

- General principles of mechanicals engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

Annotation

At the end of the lecture, participants can explain the structure and function of all discussed drive trains of mobile machines. They can analyze complex gearbox schematics and synthesize simple transmission functions using rough calculations.

Content:

In this course the different drive trains of mobile machinery will be discussed. The focus of this course is:

- mechanical gears
- torque converter
- hydrostatic drives
- power split drives
- electrical drives
- hybrid drives
- axles
- terra mechanics

Media: projector presentation

Literature: Download of lecture slides from ILIAS. Further literature recommendations during lectures.

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

Drive Train of Mobile Machines

2113077, WS 23/24, 2 SWS, Language: German, Open in study portal
Content
In this course will be discussed the different drive train of mobile machinery. The focus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- electrical drives
- hybrid drives
- axles
- terra mechanic

Recommendations:
- general basics of mechanical engineering
- basic knowledge in hydraulics
- interest in mobile machines
- regular attendance: 21 hours
- self-study: 89 hours

Literature
Skriptum zur Vorlesung downloadbar über ILIAS
3.77 Course: Dynamics of the Automotive Drive Train [T-MACH-105226]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

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

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**Competition Certificate**

Oral examination, 30 min.

**Prerequisites**

none

**Recommendation**

Powertrain Systems Technology A: Automotive Systems Machine Dynamics Vibration Theory

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

**Dynamics of the Automotive Drive Train**

2163111, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

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

**Literature**

- Pfeiffer F., Mechanical System Dynamics, Springer, 2008

**Übungen zu Dynamik des Kfz-Antriebsstrangs**

2163112, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

Exercises related to the lecture
3.78 Course: Elasticity as a Field Theory [T-MACH-112215]

**Responsible:** Dr. Eleni Agiasofitou
Dr. Markus Lazar

**Organisation:** KIT Department of Mechanical Engineering

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

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**Competence Certificate**
written exam (90 min)
3.79 Course: Electric Energy Systems [T-ETIT-101923]

**Responsible:** Prof. Dr.-Ing. Thomas Leibfried

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

**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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

**Prerequisites**

none
# 3.80 Course: Electric Power Generation and Power Grid [T-ETIT-103608]

**Responsible:** Dr.-Ing. Bernd Hoferer  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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**Legend:** 🖥 Online, ☇ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**

- none
3.81 Course: Electric Power Transmission & Grid Control [T-ETIT-110883]

**Responsible:** Prof. Dr.-Ing. Thomas Leibfried

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

**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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

**Competence Certificate**

The examination consists of a written paper and an oral presentation of the students work. The overall impression is rated.

**Prerequisites**

none
3.82 Course: Electrical Engineering and Electronics [T-ETIT-108386]

<table>
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<tr>
<th>Responsible:</th>
<th>TT-Prof. Dr. Giovanni De Carne</th>
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**Competence Certificate**
The control of success takes place by a written examination, duration 3 hours.

By successfully completing two additional exercise sheets (on a voluntary basis), a bonus of up to 6 exam points can be earned (corresponds to a maximum grade improvement of the written exam by the value 0.3 or 0.4).

**Prerequisites**
none

**Annotation**
Exam will be held in english language.
3.83 Course: Electrical Engineering and Electronics [T-ETIT-109820]

Respondible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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Exams

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

Annotation
Exam will be held in german language
T 3.84 Course: Electrical Machines and Power Electronics [T-ETIT-101954]

**Responsible:** Prof. Dr.-Ing. Marc Hiller  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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

**Prerequisites**

none
# 3.85 Course: Electronic Devices and Circuits [T-ETIT-109318]

**Responsible:** Prof. Dr.-Ing. Ahmet Cagri Ulusoy  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Legend:** 🖥 Online, 📦 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Prerequisites**
none
### 3.86 Course: Energy and Process Technology I [T-MACH-102211]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Prof. Dr. Ulrich Maas  
Dr.-Ing. Corina Schwitzke  
Dr. Amin Velji

**Organisation:** KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

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

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<tbody>
<tr>
<td>WT 23/24</td>
<td>2157961</td>
<td>Energy and Process Technology I</td>
<td>Lecture / Practice (VÜ)</td>
<td>6 SWS</td>
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**Exams**

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<th>Grade</th>
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<td>76-T-MACH-102211</td>
<td>Energy and Process Technology I</td>
<td>Lecture / Practice (VÜ)</td>
<td>Bauer, Mitarbeiter, Wagner, Maas, Schwitzke, Wirbser, Reichel</td>
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<td>ST 2024</td>
<td>76-T-MACH-102211</td>
<td>Energy and Process Technology I</td>
<td>Lecture / Practice (VÜ)</td>
<td>Bauer, Wirbser, Schwitzke, Pritz, Wagner</td>
</tr>
</tbody>
</table>

**Competence Certificate**

The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

none

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

**Energy and Process Technology I**

2157961, WS 23/24, 6 SWS, Language: German, [Open in study portal](#)

**Lecture / Practice (VÜ)**

On-Site

**Content**

The last third of the lecture deals with the topic **Thermal Turbomachinery**. The basic principles, the functionality and the scope of application of gas and steam turbines for the generation of electrical power and propulsion technology are addressed.

The students are able to:

- describe and calculate the basic physical-technical processes
- apply the mathematical and thermodynamical description
- reflect on and explain the diagrams and schematics
- comment on diagrams
- explain the functionality of gas and steam turbines and their components
- name the applications of thermal turbomachinery and their role in the field of electricity generation and propulsion technology
**3.87 Course: Energy and Process Technology II [T-MACH-102212]**

**Responsible:** Prof. Dr. Ulrich Maas  
Dr.-Ing. Corina Schwitzke

**Organisation:** KIT Department of Mechanical Engineering  
Institute of Thermal Turbomachinery

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

**Events**

<table>
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**Exams**

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<th>2170832</th>
<th>Energy and Process Technology II</th>
<th>6 SWS</th>
<th>Lecture / Practice ( /</th>
<th>Schwitzke, Pritz, Maas, Wirbser, Schmid</th>
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<td>Energy and Process Technology II</td>
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<td>Schwitzke, Wirbser, Bauer, Wagner</td>
</tr>
</tbody>
</table>

**Competence Certificate**

The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

none

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

**Energy and Process Technology II**

2170832, SS 2024, 6 SWS, Language: German, Open in study portal  
Lecture / Practice (VÜ) On-Site

**Content**

**Thermal Turbomachinery** - In the first part of the lecture deals with energy systems. Questions regarding global energy resources and their use, especially for the generation and provision of electrical energy, are addressed. Common fossil and nuclear power plants for the centralized supply with electrical power as well as concepts of power-heat cogeneration for the decentralized electrical power supply by means of block-unit heat and power plants, etc. are discussed. Moreover, the characteristics and the potential of renewable energy conversion concepts, such as wind and hydro-power, photovoltaics, solar heat, geothermal energy and fuel cells are compare and evaluated. The focus is on the description of the potentials, the risks and the economic feasibility of the different strategies aimed to protect resources and reduce CO2 emissions.

The students are able to:

- discuss and evaluate energy resources and reserves and their utility
- review the use of energy carriers for electrical power generation
- explain the concepts and properties of power-heat cogeneration, renewable energy conversion and fuel cells and their fields of application
- comment on and compare centralized and decentralized supply concepts
- calculate the potentials, risks and economic feasibility of different strategies aiming at the protection of resources and the reduction of CO2 emissions
- name and judge on the options for solar energy utilization
- discuss the potential of geothermal energy and its utilization
3.88 Course: Energy Conversion and Increased Efficiency in Internal Combustion Engines [T-MACH-105564]

**Responsible:** Prof. Dr. Thomas Koch  
Dr.-Ing. Heiko Kubach

**Organisation:** KIT Department of Mechanical Engineering

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

---

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

**Competence Certificate**  
oral exam, 25 minutes, no auxiliary means

**Prerequisites**  
none
### 3.89 Course: Energy Demand of Buildings – Fundamentals and Applications, with Building Simulation Exercises [T-MACH-105715]

<table>
<thead>
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<th>Responsible</th>
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**Competence Certificate**
oral exam, approx. 30 minutes

**Prerequisites**
none
3.90 Course: Energy from Biomass [T-CIWVT-110576]

**Responsible:** Dr.-Ing. Siegfried Bajohr  
Prof. Dr. Nicolaus Dahmen

**Organisation:** KIT Department of Chemical and Process Engineering

**Part of:** M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

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<td>Grade to a third</td>
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**Events**

| WT 23/24 | 2231220 | Energy from Biomass | 2 SWS | Lecture / 🗣 | Dahmen, Bajohr |

**Exams**

| WT 23/24 | 7233102 | Energy from Biomass | Dahmen, Bajohr |

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

**Competence Certificate**

The examination is a written examination with a duration of 90 minutes (section 4 subsection 2 number 1 SPO).

**Prerequisites**

None
3.91 Course: Energy Market Engineering [T-WIWI-107501]

Responsible: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

<table>
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Events

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<th>2 SWS</th>
<th>Lecture / Online</th>
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<td>2540465</td>
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<td>1 SWS</td>
<td>Practice / On-Site</td>
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Exams

| WT 23/24  | 7900127 | Energy Market Engineering | Weinhardt |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

Competence Certificate

The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

Prerequisites

None

Recommendation

None

Annotation

Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".
The lecture has also been added in the IIP Module Basics of Liberalised Energy Markets.

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

Energy Market Engineering

2540464, SS 2024, 2 SWS, Language: German, Open in study portal

Organizational issues

Vorlesungsstart: 25.04.24

Literature

3.92 Course: Energy Storage and Network Integration [T-MACH-105952]

**Responsible:** Dr. Ferdinand Schmidt

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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**Events**

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<td>Schmidt</td>
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<tr>
<td>2189487</td>
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<tr>
<td>Energy Storage and Grid Integration</td>
<td>Lecture / 🗣</td>
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**Exams**

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<tr>
<td>76-T-MACH-105952</td>
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<td></td>
</tr>
<tr>
<td>Energy Storage and Grid Integration</td>
<td>Lecture / 🗣</td>
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</table>

**Competence Certificate**
oral exam, about 30 minutes

**Prerequisites**
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

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

1. The course T-ETIT-104644 - Energy Storage and Network Integration must not have been started.

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

**Energy Storage and Grid Integration**

*2189487, WS 23/24, 2 SWS, Language: English, Open in study portal*

**Content**
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid. Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

Students understand the different types of energy storage and apply their knowledge for the selection and principal dimensioning of relevant energy storage tasks.

Furthermore, students can reflect the state-of-the-art of most important energy storage types, their fundamental characteristics and viability at given boundary conditions and they are enabled to elaborate and apply basic integration issues dependent on the grid structure for the different network types.

**Oral exam, duration approximately 30 min, tools: non**

**Organizational issues**
Blockvorlesung 04.-08. März 2024, Campus Nord, Geb. 521, Raum 220 (INR - Institut für Neutronenphysik und Reaktortechnik)
3.93 Course: Energy Storage and Network Integration [T-ETIT-104644]

**Responsible:** Prof. Dr. Mathias Noe  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Events**

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<td>2 SWS</td>
<td>Grilli, De Carne</td>
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<td>WT 23/24 Tutorial for 2312687 Energy Storage and Network Integration</td>
<td>Practice / 🗣️</td>
<td>1 SWS</td>
<td>De Carne, Grilli</td>
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**Exams**

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<th>Version</th>
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<td>Grilli, De Carne</td>
<td></td>
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</tbody>
</table>

**Prerequisites**

Neither participation in "Energiespeicher und Netzintegration" (ETIT) nor in "Energiespeicher und Netzintegration" (MACH). Only one out of these three exams is allowed.

**Recommendation**

Basic knowledge in the fields of Electrical Engineering and Thermodynamics is helpful.

**Annotation**

Exam and Lecture will be held in English.

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

**Tutorial for 2312687 Energy Storage and Network Integration**

2312687, WS 23/24, 1 SWS, Language: English, [Open in study portal](#)

**Content**

Campus North - dates will be announced in the beginning of the semester in the lecture

In order to gain credits, both, the lecture and the tutorial, have to be completed (participation in VL 23687 "Energy Storage and Network Integration").

**Organizational issues**

The exact dates will be announced in the lecture.
Below you will find excerpts from events related to this course:

**Content**
The course deals with fundamental aspects of renewable energies.

1. The first part deals with the basic concepts of absorbing solar beams, in an efficient manner accounting for the minimization of heat losses. In this context, selective topics on thermodynamics as well as fluid dynamics are introduced. In the second part few applications are discussed and optimizations techniques of solar collectors construction and their heat transfer are presented.
2. The use of solar energy as a source for heat generation is followed by the idea of electricity generation. Introductive aspects of Photovoltaic technologies are illuminated.
3. The last part presents additional regenerative energy sources such as wind and geothermal energy.

The student knows the principles of the feasibility of energy gain by means of renewable energies, in particular the solar energy. regular attendance: 34 hours self-study: 146 hours

Oral examination – as an elective course 30 minutes, in combination with Energiesysteme-II or other courses within the energy courses, as a major course 1 hour

**Organizational issues**
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.
3.95 Course: Energy Systems II: Reactor Physics [T-MACH-105550]

**Responsible:** Dr. Aurelian Florin Badea  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

### Type
- Oral examination

### Credits
- 4

### Grading scale
- Grade to a third

### Recurrence
- Each summer term

### Version
- 1

### Events

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<th>2130929</th>
<th>Energy systems II: Reactor Physics</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Badea</th>
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</table>

| WT 23/24 | 76-T-MACH-105550 | Energy Systems II: Reactor Physics | Badea |
| ST 2024 | 76-T-MACH-105550 | Energy Systems II: Reactor Physics | Badea |

**Legend:** 🖥 Online, ⬜ Blended (On-Site/Online), 🗣 On-Site, ☠ Cancelled

### Competence Certificate
- oral exam, 20 min

### Prerequisites
- none

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

#### Content
The goal of the course is to train the students for the field of nuclear energy using fission reactors. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. Based on the reactor physics knowledge, the students are able to understand, compare and evaluate the capabilities of different types of reactors - LWR, heavy water reactors, nuclear power systems of generation IV – as well as their fundamental nuclear safety concepts. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei,
- neutron flux, cross section, reaction rate, mean free path, chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution, power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

#### Organizational issues
- Di (30.07.2024), 09:00 bis 17:00
- Do (01.08.2024), 09:00 bis 17:00
- Fr (02.08.2024), 09:00 bis 17:00
Literature
Dieter Schmidt, Reaktortechnik, Band 1: Grundlagen, ISBN 3 7650 2003 6
### 3.96 Course: Engine Laboratory [T-MACH-105337]

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

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

**Events**

<table>
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<tr>
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<td>pass/fail</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Events**

| ST 2024 | 2134001 | Engine Laboratory | 2 SWS | Practical course / Wagner |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ☑ On-Site, ✗ Cancelled

**Competence Certificate**

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

**Prerequisites**

- none

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

**Organizational issues**

- voraussichtlich 1. vorlesungsfreie Woche im SS 2021. Wird auf der Homepage und in den Vorlesungen bekannt gegeben

**Literature**

- Versuchsbeschreibungen
3.97 Course: Engine Measurement Techniques [T-MACH-105169]

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

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

<table>
<thead>
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Events

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Exams

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<td>WT 23/24</td>
<td>Lecture</td>
<td>Engine Measurement Techniques</td>
<td>Koch</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

Prerequisites
none

Recommendation
T-MACH-102194 Combustion Engines I

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

Engine measurement techniques
2134137, SS 2024, 2 SWS, Language: German, Open in study portal

Literature

1. Grohe, H.: Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C
3.98 Course: Engineering Materials for the Energy Transition [T-MACH-109082]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Each winter term</td>
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<td>Lecture/🗣</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>Seifert, Ziebert</td>
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**Exams**

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</table>

**Legend:** 🖥 Online, 📅 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam; about 30 minutes

**Prerequisites**
T-MACH-108688 - The energetics of engineering materials for the energy transition must not have been started.

**Recommendation**
Knowledge of Materials Science.

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

**Engineering Materials for the Energy Transition**
2193007, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**
oral examination (about 30 min)
Recommendations: Knowledge of Materials Science
Workload: 120 hours

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

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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**Events**

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<td>Lecture</td>
<td>Engineering Mechanics II</td>
<td>3</td>
<td>Lecture / On-Site</td>
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**Exams**

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<td>Lecture / On-Site</td>
<td>Böhlke, Langhoff</td>
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<td>Exam</td>
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<td>3</td>
<td>Lecture / On-Site</td>
<td>Böhlke, Langhoff</td>
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</table>

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

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

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

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

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

**Engineering Mechanics II**  
2162250, SS 2024, 3 SWS, Language: German, Open in study portal  

**Content**

- bending  
- shear  
- torsion  
- stress and strain state in 3D  
- Hooke's law in 3D  
- elasticity theor in 3D  
- energy methods in elastostatics  
- approximation methods  
- stability of elastic bars

**Literature**

Vorlesungsskript  

**Engineering Mechanics II (Lecture)**  
3162010, SS 2024, 3 SWS, Language: English, Open in study portal  

Lecture (V)  
On-Site
Content

- bending
- shear
- torsion
- stress and strain state in 3D
- Hooke's law in 3D
- elasticity theorems in 3D
- energy methods in elastostatics
- approximation methods
- stability of elastic bars
3.100 Course: Engineering Mechanics III [T-MACH-112906]

**Responsible:** N.N.
Prof. Dr.-Ing. Carsten Proppe

**Organisation:** KIT Department of Mechanical Engineering

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

- **Type:** Written examination
- **Credits:** 6
- **Grading scale:** Grade to a third
- **Recurrence:** Each winter term
- **Expansion:** 1 terms
- **Version:** 1

**Competence Certificate**
Written exam, duration: 180 minutes

**Prerequisites**
Coursework in *Tutorial Engineering Mechanics III* (T-MACH-112909) must have been passed

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

1. The course T-MACH-112909 - Tutorial Engineering Mechanics III must have been passed.
3.101 Course: Engineer's Field of Work [T-MACH-105721]

**Responsible:** Prof. Dr. Martin Doppelbauer  
Prof. Dr.-Ing. Marcus Geimer

**Organisation:** KIT Department of Mechanical Engineering

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

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Legend: 🖥 Online, ⬿ Blended (On-Site/Online), ⚖ On-Site, ✗ Cancelled

**Competence Certificate**
written test
Duration: 60 minutes
result: passed / not passed
No tools or reference materials may be used during the exam.

**Prerequisites**
one

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

### Engineer's Field of Work
2114917, SS 2024, 2 SWS, Language: German, [Open in study portal]

**Lecture (V)**

**Content**

**AFI1: Organization of Companies (Marcus Geimer)**
organizational structure, organizational units, managerial structure, organization charts, project organization, relation between superior and staff, board of managing directors, management of the company, supervisory board, advisory board

**AFI2: Project Management (Marcus Geimer)**
definition of project, project manager, project team, primary processes, supporting processes

**AFI3: Personnel Development (Martin Doppelbauer)**
aplications, trainee programs, management career, professional career, career paths in companies, individual career planning, tasks of HR, manpower requirements planning, training, training-on-the-job, tools for human resource management, annual personnel talk, objective agreement

**AFI4: Scheduling (Marcus Geimer)**
Methods for detailed scheduling, network plans, critical path, Gantt-diagram, milestones

**AFI5ab: Development Processes (Martin Doppelbauer)**
research, advance development, series development, product marketing, V-model, SPALTEM-model, technical specifications, requirement specifications, clarification, concept, draft, elaboration, validation, verification, documentation, FMEA

**AFI6: Standards and Laws (Martin Doppelbauer)**
importance of standards, German and international standardization systems, committees, certification

**AFI7: Commercial Law (Martin Doppelbauer)**
health protection, safety at work, environment protection, product liability, patents

**AFI8: Calculation, Financial Statement (Marcus Geimer)**
contract award estimate, project costing, unit cost, target costs, cost center accounting, cost recording, hourly rates, asset accounting, profit and loss statement

**AFI9: Governance (Marcus Geimer)**
principles of governance (accountability, responsibility, transparency, fairness), leadership (technical, commercial), reviews, boards, audits, codetermination, compliance
3.102 Course: Entrepreneurship [T-WIWI-102864]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

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Events

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Exams

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

Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Students are offered the opportunity to earn a grade bonus through separate assignments. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

Prerequisites
None

Recommendation
None

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

Entrepreneurship
2545001, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)
Content
The lecture as an obligatory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are presented that relate to the conception and implementation of newly founded companies.

The focus here is on the introduction to methods for generating innovative business ideas, for transferring patents into business concepts and general principles of business modelling and business planning. In particular approaches such as Lean Startup and Effectuation as well as concepts for the financing of young enterprises are treated.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:
The students are introduced to the topic Entrepreneurship. After successful attendance of the meeting they are to have an overview of the subranges of the Entrepreneurships and be able to understand basic concepts of the Entrepreneurships and apply key concepts.

Workload:
Total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:
The assessment of success takes place in the form of a written examination (60 min.) (according to §4(2), 1 SPO). The grade is the grade of the written exam.

A grade bonus can be earned through successful participation in a case study in the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam date: tba

Organizational issues
VL findet jeweils Mo, 15:45 - 19:00 an folgenden Terminen statt:
23.10.2023
30.10.2023
06.11.2023
13.11.2023
20.11.2023
27.11.2023
04.12.2023
11.12.2023 (Prep Session)

Literature
Füglistaller, Urs, Müller, Christoph and Volery, Thierry (2008): Entrepreneurship
Content
The lecture as a compulsory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are introduced, which relate to the conception and implementation of newly founded companies.

The focus here is on introducing methods for generating innovative business ideas, translating patents into business concepts, and general principles of business modeling and business planning. In particular, approaches such as Lean-Startup and Effectuation as well as concepts for financing young companies are covered.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in the practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

Learning objectives:
The students will be introduced to the topic of entrepreneurship. After successful attendance of the course, they should have an overview of the sub-areas of entrepreneurship and be able to understand basic concepts of entrepreneurship and apply key concepts.

Workload:
The total effort with 3 credit points: approx. 90 hours
Presence time: 30 hours
Pre- and postprocessing of the LV: 45.0 hours
Exam and exam preparation: 15.0 hours

Examination:
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation)
A grade bonus can be earned by successfully participating in a case study as part of the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam dates: tbd

Organizational issues
VL findet jeweils Di, 15:45 - 19:00 an folgenden Terminen statt:
16.04.2024
23.04.2024
30.04.2024
07.05.2024
14.05.2024
28.05.2024
04.06.2024
11.06.2024 (Prep Session)
18.06.2024 (Klausur)

Literature
Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship
Ries, Eric (2011): The Lean Startup
### 3.103 Course: Exercises - Fatigue of Welded Components and Structures [T-MACH-109304]

<table>
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<tr>
<th>Responsible:</th>
<th>Dr. Majid Farajian</th>
</tr>
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<td>KIT Department of Mechanical Engineering</td>
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<td>Part of:</td>
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<td>Recurrence</td>
<td>Each winter term</td>
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<td>Version</td>
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**Competence Certificate**

successful solving of all exercises

**Prerequisites**

none
3.104 Course: Exercices - Tribology [T-MACH-109303]

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

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

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<th>Tribology</th>
<th>5 SWS</th>
<th>Lecture / Practice ( / )</th>
<th>Dienwiebel, Scherge</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

Competence Certificate
successful solving of all exercises

Prerequisites
none

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

<table>
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<tr>
<th>Tribology</th>
<th>2181114, WS 23/24, 5 SWS, Language: German, Open in study portal</th>
<th>Lecture / Practice (VÜ)</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
Content

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Strieber plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

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

3.105 Course: Exercises for Applied Materials Simulation [T-MACH-107671]

**Responsible:** Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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<th>Lecture / Practice ( VÜ)</th>
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Legend: 📱 Online, 🗬 Blended (On-Site/Online), 📚 On-Site, ✗ Cancelled

**Competence Certificate**

successful solving of all exercises

**Prerequisites**

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

---

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

**Applied Materials Simulation**

2182614, SS 2024, 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

---

**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**


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

Module Handbook as of 23/02/2024
3.106 Course: Exercises for Materials Characterization [T-MACH-107685]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider

Organisation: KIT Department of Mechanical Engineering

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

<table>
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Events

| ST 2024 | 2174586 | Materials Characterization | 2 SWS | Lecture / 🗣 | Gibmeier, Peterlechner |
| ST 2024 | 2174988 | Tutorials and lab courses for "materials characterization" | 1 SWS | Practice / 🗣 | Gibmeier, Peterlechner |

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

Competence Certificate
Regular attendance

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110945 - Exercises for Materials Characterization must not have been started.

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

Materials Characterization
2174586, SS 2024, 2 SWS, Language: German, Open in study portal

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.

Tutorials and lab courses for "materials characterization"
2174988, SS 2024, 1 SWS, Language: German, Open in study portal

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

Organizational issues
Die Termine und der Ort zu den Übungen und Laborbesuche zur Vorlesung Werkstoffanalytik (V-Nr. 2174586) werden in der Vorlesung bekanntgegeben.
The dates and locations of the tutorials and lab courses for the lecture materials characterization (V-No. 2174586) will be announced in one of the first lectures.
Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).
Literatur wird zu Beginn der Veranstaltung bekanntgegeben.
3 COURSES

Course: Exercises for Materials Characterization [T-MACH-110945]

3.107 Course: Exercises for Materials Characterization [T-MACH-110945]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider

Organisation: KIT Department of Mechanical Engineering

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

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Exams

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

Competence Certificate

Regular attendance

Prerequisites

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

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must not have been started.

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

Tutorials and Lab Courses for "Materials Characterization"

2173432, WS 23/24, 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.
3.108 Course: Exercises for Microstructure-Property-Relationships [T-MACH-110930]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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

**Competence Certificate**  
Successful participation in a final colloquium

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

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

**Exercises in Microstructure-Property-Relationships**  
2177021, WS 23/24, 1 SWS, Language: English, Open in study portal

**Practice (Ü)**  
On-Site

**Content**  
Exercise course for the lecture Microstructure-Property-Relationships LV Nr. 2177020.

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

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Completed coursework  

**Credits**  
2

**Grading scale**  
Pass/fail

**Recurrence**  
Each winter term

**Version**  
4

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**Events**

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

**Competence Certificate**  
Successful processing of exercises

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

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

**Exercises for Solid State Reactions and Kinetics of Phase Transformations**  
2193004, WS 23/24, 1 SWS, Language: German, Open in study portal

**Content**

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

**Recommendations:** Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry  
Reinforcement of the lecture by the solution of practical and lecture-relevant exercises  
Regular attendance: 14 hours  
Self-study: 46 hours

**Literature**  
Vorlesungsskript;  
Lecture notes
Course: Experimental Dynamics [T-MACH-105514]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

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

### Events

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</table>

**Competence Certificate**

oral exam, 30 min.

**Prerequisites**

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

**Modeled Conditions**

The following conditions have to be fulfilled:

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

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

**Experimental Dynamics**

2162225, SS 2024, 3 SWS, Language: German, Open in study portal

**Lecture (V)**

Cancelled

**Content**

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

**Organizational issues**

Die Vorlesung Experimentelle Dynamik wird im Sommersemester 2024 nicht angeboten.
3.111 Course: Experimental Fluid Mechanics [T-MACH-105512]

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

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

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Exams

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</table>

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

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

**Experimental Fluid Mechanics**
2153530, WS 23/24, 2 SWS, Language: English,
Lecture (V)
Blended (On-Site/Online)

Content

The students can describe the relevant physical principles of experimental fluid mechanics. They are qualified to comparatively discuss the introduced measurement techniques. Furthermore, they are able to distinguish (dis-)advantages of the respective approaches. The students can evaluate and discuss measurement signal and data obtained with the common fluid mechanical measuring techniques.

This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Literature

Content
This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Organizational issues
Die Vergabe von Leistungspunkten zu den Veranstaltungen mit LVNr 2154446 und 2153530 schließt sich gegenseitig aus.

Literature
3.112 Course: Experimental Lab Class in Welding Technology, in Groups [T-MACH-102099]

**Responsible:** Dr.-Ing. Stefan Dietrich

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

| WT 23/24   | 2173560 | Welding Lab Course, in groups | 3 SWS | Practical course / On-Site, Schulze |

**Exams**

| WT 23/24   | 76-T-MACH-102099 | Experimental Lab Class in Welding Technology, in Groups | Dietrich |

Legend: 📱 Online, ☞ Blended (On-Site/Online), 🕊 On-Site, ✗ Cancelled

**Competence Certificate**

Certificate to be issued after evaluation of the lab class report.

**Prerequisites**

Certificate of attendance for Welding technique (The participation in the course Welding Technology I/II is assumed.).

**Annotation**

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.

You need sturdy shoes and long clothes!

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

**Welding Lab Course, in groupes**

2173560, WS 23/24, 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 welded with different welding processes.

**Requirements:**

You need sturdy shoes and long clothes!

**Workload:**

regular attendance: 31,5 hours
preparation: 8,5 hours
lab report: 80 hours
Organizational issues
Die Lehrveranstaltung "Experimentelles schweißtechnisches Praktikum" findet dieses Jahr wieder in der Woche vom 12. – 16.2.2024 statt. Der Veranstaltungsort ist die Bildungsakademie Handwerkskammer Karlsruhe
Hertzstr. 177
76187 Karlsruhe

Die Gruppeneinteilung in die beiden Gruppen findet Anfang Februar statt!

- Gruppe 1. Montag 7.30 Uhr bis Mittwoch 12.00 Uhr
- Gruppe 2. Mittwoch 13.00 Uhr bis Freitag 15.00 Uhr

Sollte aufgrund anderer LV oder Prüfungen für Sie nur eine der beiden Gruppen in Frage kommen, melden Sie sich bitte rechtzeitig bis 4.2.24 unter iam-wk-lehre@iam.kit.edu

Bitte bringen Sie festes und geschlossenes Schuhwerk (optimalerweise 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
## 3.113 Course: Fabrication Processes in Microsystem Technology [T-MACH-102166]

**Responsible:** Dr. Klaus Bade  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>Lecture / 🧩</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

### Competence Certificate

Oral examination, 20 minutes

### Prerequisites

none

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

### Fabrication Processes in Microsystem Technology

**2143882, WS 23/24, 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  

### Content

The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included.
Literature

M. Madou
Fundamentals of Microfabrication
CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul
Mikrosystemtechnik für Ingenieure
Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
### 3.114 Course: Failure Analysis [T-MACH-105724]

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

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
2

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### Events

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### Exams

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### Competence Certificate

oral examination, ca. 30 min

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### Prerequisites

none

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### Recommendation

basic knowledge in materials science (e.g. lecture materials science I and II)

---

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

### 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

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### Literature

### Course: Failure of Structural Materials: Deformation and Fracture [T-MACH-102140]

**Responsible:** Prof. Dr. Peter Gumbsch  
Dr. Daniel Weygand  

**Organisation:** KIT Department of Mechanical Engineering

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

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#### Exams

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚽ On-Site, ✗ Cancelled

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

**Prerequisites**
none

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

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

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚽ On-Site, ✗ Cancelled
Content

1. Introduction
2. Linear elasticity
3. Classification of stresses
4. Failure due to plasticity
   - Tensile test
   - Dislocations
   - Hardening mechanisms
   - Guidelines for dimensioning
5. Composite materials
6. Fracture mechanics
   - Hypotheses for failure
   - Linear elastic fracture mechanics
   - Crack resistance
   - Experimental measurement of fracture toughness
   - Defect measurement
   - Crack propagation
   - Application of fracture mechanics
   - Atomistics of fracture

The student

- has the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- can explain the foundation of linear elastic fracture mechanics and is able to determine if this concept can be applied to a failure by fracture.
- can describe the main empirical materials models for deformation and fracture and can apply them.
- has the physical understanding to describe and explain phenomena of failure.

Preliminary knowledge in mathematics, mechanics and materials science recommended

Regular attendance: 22.5 hours
Self-study: 97.5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Organizational issues

Übungstermine werden in der Vorlesung bekannt gegeben!

Nach aktuellem Stand Präsenz

Literature

- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
3.116 Course: Failure of Structural Materials: Fatigue and Creep [T-MACH-102139]

Responsible: Dr. Patric Gruber
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Credits</th>
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<td>Each winter term</td>
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Events

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| WT 23/24 2181715 | Failure of Structural Materials: Fatigue and Creep | 2 SWS | Lecture / Gruber, Gumbsch

Exams

<table>
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<th>Credits</th>
<th>Grading</th>
<th>Recurrence</th>
<th>Version</th>
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| WT 23/24 76-T-MACH-102139 | Failure of Structural Materials: Fatigue and Creep | Gruber, Gumbsch

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

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

Prerequisites
none

Recommendation
preliminary knowledge in mathematics, mechanics and materials science

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

Failure of Structural Materials: Fatigue and Creep
2181715, WS 23/24, 2 SWS, Language: German, Open in study portal
Course: Failure of Structural Materials: Fatigue and Creep [T-MACH-102139]

Content
1 Fatigue
1.1 Introduction
1.2 Lifetime
1.3 Fatigue Mechanisms
1.4 Material Selection
1.5 Notches and Shape Optimization
1.6 Case Studies: ICE-Accidents

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phenomenological Description of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

The student
- has the basic understanding of mechanical processes to explain the relationships between externally applied load and materials strength.
- can describe the main empirical materials models for fatigue and creep and can apply them.
- has the physical understanding to describe and explain phenomena of failure.
- can use statistical approaches for reliability predictions.
- can use its acquired skills, to select and develop materials for specific applications.

preliminary knowledge in mathematics, mechanics and materials science recommended
regular attendance: 22.5 hours
self-study: 97.5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene
3.117 Course: Fatigue of Materials [T-MACH-112106]

**Responsible:** Dr.-Ing. Stefan Guth  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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<th>Lecture</th>
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<tr>
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<td>2173586</td>
<td>Fatigue of Materials</td>
<td>2 SWS</td>
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Legend:  🖥 Online,  🧩 Blended (On-Site/Online),  🗣 On-Site,  ❌ Cancelled

**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

**Recommendation**

Basic knowledge in Materials Science will be helpful.

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

**Fatigue of Materials**

2173586, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**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.
3.118 Course: Fatigue of Welded Components and Structures [T-MACH-105984]

**Responsible:** Dr. Majid Farajian

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
oral examination (ca. 30 min)
no tools or reference materials

**Prerequisites**
admission to the exam only with successful completion of the exercises [T-MACH-109304]

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

1. The course T-MACH-109304 - Excercises - Fatigue of Welded Components and Structures must have been passed.

**Recommendation**
preliminary knowlegde materials science and mechanics
3 COURSES

Course: FEM Workshop - Constitutive Laws [T-MACH-105392]

3.119 Course: FEM Workshop - Constitutive Laws [T-MACH-105392]

Responsible: PD Dr.-Ing. Katrin Schulz
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

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

<table>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⬇ On-Site, ✗ Cancelled

Competence Certificate
- solving of a FEM problem
- preparation of a report
- preparation of a short presentation

Prerequisites
none

Recommendation
Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials

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

FEM Workshop -- Constitutive Laws
2183716, SS 2024, 2 SWS, Language: German, Open in study portal

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student
- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading
- solving of a FEM problem
- preparation of a report
- preparation of a short presentation

Organizational issues
Blockveranstaltung, Termine werden noch bekannt gegeben!
Anmeldung per Email bis zum 26.04.2024 an katrin.schulz@kit.edu
3.120 Course: Financial Analysis [T-WIWI-102900]

**Responsible:** Dr. Torsten Luedecke  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-MACH-104884 - Courses of the KIT Department of Economics and Management

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**Events**

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**Exams**

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

**Competence Certificate**

See German version.

**Prerequisites**

None

**Recommendation**

Basic knowledge in corporate finance, accounting, and valuation is required.

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

**Financial Analysis**

2530205, SS 2024, 2 SWS, Language: German, Open in study portal

**Literature**

### 3.121 Course: Finite Difference Methods for Numerical Solution of Thermal and Fluid Dynamical Problems [T-MACH-105391]

**Responsible:** Prof. Dr. Claus Günther  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Competence Certificate**  
oral exam, Duration: 30 minutes  
no auxiliary means

**Prerequisites**  
none
### Course: Finite Element Workshop [T-MACH-105417]

**Responsible:** Prof. Dr. Claus Mattheck  
Dr. Daniel Weygand  

**Organisation:** KIT Department of Mechanical Engineering

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

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚫ On-Site, ⓞ Cancelled

**Competence Certificate**  
attendance certificate for participation in all course dates

**Prerequisites**  
none

**Recommendation**  
Continuum Mechanics

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

**Finite Element Workshop**  
2182731, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Content**

The students will learn the foundations of the FEM stress analysis and the optimization method 'Zugdreiecke'.

The student can

- perform stress analysis for simple components using the commercial software package ANSYS
- utilise the method of the tensile triangle to optimize the shape of components with respect to stress distribution

Fundamentals of Continuum Mechanics are required.

**Regular attendance:** 22.5 hours  
**Certificate in case of regular attendance**

**Organizational issues**

**Weitere Veranstaltung im Sommersemester 2024:**

Der Finite-Elemente Workshop findet vom 02. bis 05. April 2024 am CN, Bau 421, Raum 413 statt.

Bei Interesse wenden Sie sich bitte an: iwiza.tesari@kit.edu
3.123 Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

**Responsible:** Prof. Dr.-Ing. Xu Cheng

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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**Tutorial 'Flows and Heat Transfer in Energy Technology'**

1 SWS  Practice / Blended (On-Site/Online)

Cheng, Mitarbeiter

**Exams**

<table>
<thead>
<tr>
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<th>76-T-MACH-105403</th>
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</table>

**Flows and Heat Transfer in Energy Technology**

Cheng

**Competence Certificate**

oral exam, 20 min

**Prerequisites**

none
### 3.124 Course: Flows with Chemical Reactions [T-MACH-105422]

**Responsible:** apl. Prof. Dr. Andreas Class  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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**Exams**

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**Legend:**  
- 🖥 Online  
- 🧩 Blended (On-Site/Online)  
- 🗣 On-Site  
- ✗ Cancelled

**Competence Certificate**

oral exam, duration 30 minutes  
Auxiliary none

**Prerequisites**

none

**Recommendation**

Fluid Mechanics (T-MACH-105207)  
Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

### Flows with chemical reactions

**2153406, WS 23/24, 2 SWS, Language: German/English, Open in study portal**

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

**Content**

The students can describe flow scenarios, where a chemical reaction is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficient numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaction is confined to a thin layer. The problems are solved analytically or they are at least simplified allowing for efficient numerical solution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

**Literature**

Vorlesungsskript  
Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983
3.125 Course: Fluid Mechanics [T-MACH-112933]

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

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

<table>
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<td>Each summer term</td>
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**Competence Certificate**  
Written exam 2h

**Prerequisites**  
none
# 3.126 Course: Fluid Mechanics of Turbulent Flows [T-BGU-110841]

**Responsible:** Prof. Dr.-Ing. Markus Uhmann  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

<table>
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### Exams

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

### Competence Certificate

oral exam, appr. 45 min.

### Prerequisites

none

### Recommendation

none

### Annotation

none
3.127 Course: Fluid Power Systems [T-MACH-102093]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer  
**Organisation:** KIT Department of Mechanical Engineering

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

**Events**

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**Exams**

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<th>2 SWS</th>
<th>Lecture / On-Site</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

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

**Prerequisites**

none

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

**Fluid Technology**

2114093, WS 23/24, 2 SWS, Language: German, [Open in study portal]

**Lecture (V) On-Site**

**Content**

In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

- regular attendance: 21 hours
- self-study: 92 hours

**Literature**

Skriptum zur Vorlesung Fluidtechnik  
Institut für Fahrzeugsystemtechnik  
downloadbar
Course: Fluid-Structure-Interaction [T-MACH-105474]

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Mark-Patrick Mühlhausen

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**
- Oral examination

**Credits**
- 4

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 1

**Events**

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<th>Events</th>
<th>Credits</th>
<th>Description</th>
<th>Type</th>
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<tbody>
<tr>
<td>ST 2024</td>
<td>2 SWS</td>
<td>Fluid-Structure-Interaction with Python</td>
<td>Oral examination</td>
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**Exams**

<table>
<thead>
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<th>Events</th>
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<td>ST 2024</td>
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<td>Fluid-Structure-Interaction with Python</td>
<td>Oral examination</td>
</tr>
</tbody>
</table>

**Competence Certificate**
- Oral exam 30 minutes

**Prerequisites**
- None

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

**Fluid-Structure-Interaction with Python**
- 2154453, SS 2024, 2 SWS, Language: German, [Open in study portal]

**Content**
- The lecture provides the basics for the description and modeling of flows, structures and their interaction. In the practical part, the covered methods and procedures are deepened with various exercises and examples with Python and Ansys Fluent.
  - Brief introduction to Python and Ansys Fluent
  - Basic equations of continuum mechanics
  - Smoothing and remeshing algorithms for mesh deformation
  - Finite volume and finite element method
  - Methods of fluid-structure interaction
  - Coupling conditions
  - Monolithic and partitioned coupling methods
  - Coupling algorithms for partitioned methods
  - Stability and convergence of coupled systems

**Organizational issues**
- Die Anmeldung bitte bis zum 18.07.24 an sekretariat@istm.kit.edu schicken.

**Literature**
- wird in der Vorlesung vorgestellt
3.129 Course: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

Responsibility: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events

| WT 23/24 | 2181720 | Foundations of nonlinear continuum mechanics | 2 SWS | Lecture / 🗣 | Kamlah |

Exams

| WT 23/24 | 76-T-MACH-105324 | Foundations of Nonlinear Continuum Mechanics | Kamlah |

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

Competence Certificate
oral exam

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

**Foundations of nonlinear continuum mechanics**
2181720, WS 23/24, 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.

regular attendance: 22,5 hours
self-study: 97,5 hours
oral exam ca. 30 minutes

Organizational issues
Die Vorlesung findet im WS 23/24 nicht statt.

Literature
Vorlesungsskript
3.130 Course: Foundry Technology [T-MACH-105157]

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

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

<table>
<thead>
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<td>Each summer term</td>
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Events

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<th>2174575</th>
<th>Foundry Technology</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Schulze, Dietrich</th>
</tr>
</thead>
</table>

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

Competence Certificate
oral exam; about 25 minutes

Prerequisites
Materials Science I & II must be passed.

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

<table>
<thead>
<tr>
<th>V Foundry Technology</th>
<th>Lecture (V)</th>
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<tbody>
<tr>
<td>2174575, SS 2024, 2 SWS, Language: German, [Open in study portal]</td>
<td>On-Site</td>
</tr>
</tbody>
</table>

Literature
Literaturhinweise werden in der Vorlesung gegeben
Reference to literature, documentation and partial lecture notes given in lecture
3.131 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

**Responsible:** Hon.-Prof. Dr. Bernhard Ulrich Kehrwald
Dr.-Ing. Heiko Kubach

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<tbody>
<tr>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<th>Recurrence</th>
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<tr>
<td>WT 23/24</td>
<td>2133108 Fuels and Lubricants for Combustion Engines</td>
<td>2 SWS</td>
<td>Lecture / Kehrwald</td>
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**Exams**

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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>76-T-MACH-105184 Fuels and Lubricants for Combustion Engines</td>
<td></td>
<td>Kehrwald</td>
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</table>

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

**Prerequisites**
none

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

**Fuels and Lubricants for Combustion Engines**
2133108, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**
electric drives and fuel cell drives with the associated operating materials will also be presented

- Introduction, basics, primary energy and energy chains
- Illustrative chemistry of hydrocarbons
- Fossil fuels, exploration, processing, standards
- Operating materials not fossil, renewable, alternative
- Fuels, lubricants, coolants, AdBlue
- Laboratory analysis, testing, test benches and measurement technology
- Excursion to test fields for motorized drives from 0.5 to 3,500 kW

**Literature**
Skript
3.132 Course: Functional Ceramics [T-MACH-105179]

**Responsible:** Dr. Manuel Hinterstein  
Dr.-Ing. Wolfgang Rheinheimer

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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<tbody>
<tr>
<td>WT 23/24 2126784</td>
<td>2 SWS</td>
<td>Functional Ceramics</td>
<td>Lecture / Online</td>
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**Exams**

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<tbody>
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<td>Hinterstein</td>
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<tr>
<td>ST 2024 76-T-MACH-105179</td>
<td>Functional Ceramics</td>
<td>Hinterstein</td>
<td></td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⏰ On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of an oral exam (20 min) taking place at the agreed date.

Auxiliary means: none

The re-examination is offered upon agreement.

**Prerequisites**

none
### Course: Fundamental Numerical Algorithms for Engineers [T-BGU-109953]

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

<table>
<thead>
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<th>Recurrence</th>
<th>Version</th>
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<tr>
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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

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<th>Credits</th>
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<th>Recurrence</th>
<th>Organisers</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Fundamental Numerical Algorithms for Engineers</td>
<td>Each term</td>
<td>Uhlmann, Herlina</td>
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**Exams**

<table>
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<th>Type</th>
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</tr>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>0 SWS</td>
<td>Fundamental Numerical Algorithms for Engineers</td>
<td>Uhlmann, Herlina</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Written exam, 60 min.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

None

**Responsible:** Dipl.-Ing. Horst Dietmar Bardehle  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
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<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Events**

| WT 23/24 | 2113814 | Fundamentals for Design of Motor-Vehicle Bodies I | 1 SWS | Lecture / 🗣 | Bardehle |

**Exams**

| WT 23/24 | 76-T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | Unrau, Bardehle |

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

**Competence Certificate**

Oral group examination

**Duration:** 30 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

**Fundamentals for Design of Motor-Vehicle Bodies I**

2113814, WS 23/24, 1 SWS, Language: German, Open in study portal

**Content**

1. History and design
2. Aerodynamics
3. Design methods (CAD/CAM, FEM)
4. Manufacturing methods of body parts
5. Fastening technology
6. Body in white / body production, body surface

**Learning Objectives:**
The students have an overview of the fundamental possibilities for design and manufacture of motor-vehicle bodies. They know the complete process, from the first idea, through the concept to the dimensioned drawings (e.g. with FE-methods). They have knowledge about the fundamentals and their correlations, to be able to analyze and to judge relating components as well as to develop them accordingly.

**Organizational issues**

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

Termine und nähere Informationen: siehe ILIAS oder Institutshomepage

Dates and further information will be published on the homepage of the institute

**Literature**

1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)  
Module Handbook as of 23/02/2024
Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

**Responsible:** Dipl.-Ing. Horst Dietmar Bardehle

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**
- Oral examination

**Credits**
- 2

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 1

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### Events

<table>
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<th>ST 2024</th>
<th>2114840</th>
<th>Fundamentals for Design of Motor-Vehicle Bodies II</th>
<th>1 SWS</th>
<th>Lecture / 🗣</th>
<th>Bardehle</th>
</tr>
</thead>
</table>

| Exams |
| WT 23/24 | 76-T-MACH-102119 | Fundamentals for Design of Motor-Vehicle Bodies II | Bardehle |

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### Competence Certificate

Oral group examination

**Duration:** 30 minutes

**Auxiliary means:** none

**Prerequisites**

none

---

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

### Content

1. Body properties/testing procedures
2. External body-parts
3. Interior trim
4. Compartment air conditioning
5. Electric and electronic features
6. Crash tests
7. Project management aspects, future prospects

**Learning Objectives:**

The students know that, often the design of seemingly simple detail components can result in the solution of complex problems. They have knowledge in testing procedures of body properties. They have an overview of body parts such as bumpers, window lift mechanism and seats. They understand, as well as, parallel to the normal electrical system, about the electronic side of a motor vehicle. Based on this they are ready to analyze and to judge the relation of these single components. They are also able to contribute competently to complex development tasks by imparted knowledge in project management.

---

### Organizational issues

Voraussichtliche Termine, nähere Informationen und evtl. Änderungen:

siehe Institutshomepage.

Scheduled dates, further Information and possible changes of date:

see homepage of the institute.

---

### Literature

1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg
3.136 Course: Fundamentals in the Development of Commercial Vehicles [T-MACH-111389]

**Responsible:** Christof Weber  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
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<th>Credits</th>
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<th>Recurrence</th>
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<td>see Annotations</td>
<td>2 terms</td>
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**Events**

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<td>Lecture</td>
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<td>Lecture / On-Site</td>
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**Exams**

<table>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>1 SWS</td>
<td>Lecture / On-Site</td>
<td>Weber</td>
<td>Weber</td>
<td>Weber</td>
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</tbody>
</table>

**Competence Certificate**  
Oral group examination  
Duration: appr. 30 minutes  
Auxiliary means: none

**Prerequisites**  
none

**Annotation**  
Fundamentals in the Development of Commercial Vehicles I, WT  
Fundamentals in the Development of Commercial Vehicles II, ST

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

**Fundamentals in the Development of Commercial Vehicles I**  
2113812, WS 23/24, 1 SWS, Language: German, [Open in study portal](#)

**Content**

1. Introduction, definitions, history  
2. Development tools  
3. Complete vehicle  
4. Cab, bodyshell work  
5. Cab, interior fitting  
6. Alternative drive systems  
7. Drive train  
8. Drive system diesel engine  
9. Intercooled diesel engines

**Learning Objectives:**

The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.

The students are able to develop parts and components. Furthermore they have knowledge about different cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.
Organizational issues

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

Termine und Nähere Informationen: siehe ILIAS oder Institutshomepage

Dates and further information will be published on the homepage of the institute.

Literature

Fundamentals in the Development of Commercial Vehicles II
2114844, SS 2024, 1 SWS, Language: German, Open in study portal

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 front axle etc. Besides other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known. Consequently the student are able to analyze and to judge the general concepts as well as to adjust them precisely with the area of application.

Organizational issues

Genaue Termine sowie nähere Informationen und eventuelle Terminänderungen:
siehe Institutshomepage.

Literature
1. HILGERS, M.: Nutzfahrzeugtechnik lernen, Springer Vieweg, ISSN: 2510-1803
3.137 Course: Fundamentals of Automobile Development I [T-MACH-105162]

**Responsible:** Prof.Dipl.-Ing. Rolf Frech

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
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<th>Recurrence</th>
<th>Version</th>
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<td>Each winter term</td>
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**Events**

<table>
<thead>
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<th>SWS</th>
<th>Type</th>
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<tr>
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<td>Fundamentals of Automobile Development I</td>
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<td>WT 23/24 2113851</td>
<td>Principles of Whole Vehicle Engineering I</td>
<td>1</td>
<td>Lecture / On-Site</td>
<td>Frech</td>
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**Exams**

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<th>SWS</th>
<th>Type</th>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Written examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**

none

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

**Fundamentals of Automobile Development I**

2113810, WS 23/24, 1 SWS, Language: German, Open in study portal

**Content**

1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

**Learning Objectives:**

The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

**Organizational issues**

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

Termine und nähere Informationen finden Sie auf der Institutshomepage.

Kann nicht mit Lehrveranstaltung 2113851 kombiniert werden.

Date and further information will be published on the homepage of the institute.

Cannot be combined with lecture 2113851.
Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben
The scriptum will be provided during the first lessons

Principles of Whole Vehicle Engineering I
2113851, WS 23/24, 1 SWS, Language: English, Open in study portal

Content
1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

Learning Objectives:
The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Organizational issues
You will find the lecture material on ILIAS. To get the ILIAS password, KIT students refer to https://fast-web-01.fast.kit.edu/Passwoerterilias/
Termine und nähere Informationen finden Sie auf der Institutshomepage.
Dats and further information will be published on the homepage of the institute.
Kann nicht mit Lehrveranstaltung 2113810 kombiniert werden
Cannot be combined with lecture 2113810.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben
The scriptum will be provided during the first lessons
### 3.138 Course: Fundamentals of Automobile Development II [T-MACH-105163]

**Responsible:** Prof. Dipl.-Ing. Rolf Frech

**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Written examination  
**Credits:** 2  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 2

#### Events

<table>
<thead>
<tr>
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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>2</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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#### Exams

<table>
<thead>
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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
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<td>2</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Competence Certificate**

Written examination

**Duration:** 90 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

#### Principles of Whole Vehicle Engineering II

**2114842, SS 2024, 1 SWS, Language: German, Open in study portal**

**Content**

1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

**Learning Objectives:**

The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

**Organizational issues**

Vorlesung findet als Blockvorlesung an folgenden Terminen statt: 02.05., 16.05., 06.06. 2024, jeweils von 08:00 bis 11:00 Uhr.

Kann nicht mit der Veranstaltung [2114860] kombiniert werden.

Cannot be combined with lecture [2114860].

**Literature**

Skript zur Vorlesung ist über ILIAS verfügbar.
Principles of Whole Vehicle Engineering II
2114860, SS 2024, 1 SWS, Language: English, Open in study portal

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Learning Objectives:
The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Organizational issues
Veranstaltung findet als Blockvorlesung an folgenden Terminen statt: 02.05., 16.05., 06.06.2024 von 11:15 bis 14:00 Uhr.

Scheduled dates:
see homepage of the institute.
Kann nicht mit der Veranstaltung [2114842] kombiniert werden.
Cannot be combined with lecture [2114842].

Literature
Das Skript zur Vorlesung ist über ILIAS verfügbar.
3.139 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

**Responsible:** Prof. Dr. Olaf Deutschmann  
Prof. Dr. Jan-Dierk Grunwaldt  
Dr.-Ing. Heiko Kubach  
Hon.-Prof. Dr. Egbert Lox

**Organisation:** KIT Department of Mechanical Engineering

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

### Events

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<td>Each summer term</td>
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**Legend:**  
- Online  
- Blended (On-Site/Online)  
- On-Site  
- Cancelled

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

**Prerequisites**  
none

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

#### Literature

3.140 Course: Fundamentals of Combustion Engine Technology [T-MACH-105652]

Responsible: Dr.-Ing. Sören Bernhardt
Dr.-Ing. Heiko Kubach
Jürgen Pfeil
Dr.-Ing. Olaf Toedter
Dr.-Ing. Uwe Wagner

Organisation: KIT Department of Mechanical Engineering

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

Type: Written examination
Credits: 5
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 2

Events

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<th>Version</th>
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Competence Certificate
written exam, 60 min.

Prerequisites
none

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

Fundamentals of Combustion Engine Technology
2133123, WS 23/24, 2 SWS, Language: German, Open in study portal

Content
Fundamentals of engine processes
Components of combustion engines
Mixture formation systems
Gas exchange systems
Injection systems
Exhaust Gas Aftertreatment Systems
Cooling systems
Ignition Systems
### 3.141 Course: Fundamentals of Combustion I [T-MACH-105213]

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

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

<table>
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#### Exams

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#### Legend:

- 🖥 Online
- 🩹 Blended (On-Site/Online)
- 🗣 On-Site
- 🗑 Cancelled

#### Competence Certificate

Written exam, approx. 3 hours

#### Prerequisites

none

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

#### Fundamentals of Combustion I

**V 2165515, WS 23/24, 2 SWS, Language: German, Open in study portal**

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

**Content**

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

**Organizational issues**

Beim zu wenigen Hörern wird die Lehrveranstaltung mit der englischen Lehrveranstaltung zusammengelegt.

**Literature**

Vorlesungsskript,


#### Fundamentals of Combustion I (Tutorial)

**V 2165517, WS 23/24, 1 SWS, Language: German, Open in study portal**

**Practice (Ü)**  
**On-Site**
Literature

- Vorlesungsskript

**Fundamentals of Combustion I**
3165016, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)

**Content**

- Fundamental concepts and phenomena
- Experimental analysis of flames
- Conservation equations for laminar flat flames
- Chemical reactions
- Chemical kinetics mechanisms
- Laminar premixed flames
- Laminar diffusion flames
- Ignition processes
- NOx formation
- Formation of hydrocarbons and soot

**Literature**

Vorlesungsskript,

### 3.142 Course: Fundamentals of Energy Technology [T-MACH-105220]

**Responsible:** Dr. Aurelian Florin Badea  
Prof. Dr.-Ing. Xu Cheng  

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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**Events**

| ST 2024 | 2130927 | Fundamentals of Energy Technology | 3 SWS | Lecture / On-Site | Cheng, Badea |
| ST 2024 | 3190923 | Fundamentals of Energy Technology | 3 SWS | Lecture / On-Site | Badea |

**Exams**

| WT 23/24 | 76-T-MACH-105220 | Fundamentals of Energy Technology | Badea, Cheng |
| ST 2024 | 76-T-MACH-105220 | Fundamentals of Energy Technology | Cheng, Badea |
| ST 2024 | 76-T-MACH-105220 | Fundamentals of Energy Technology | Badea |

Legend: 🖥 Online, ☝ Blended (On-Site/Online), 🗠 On-Site, ✗ Cancelled

**Competence Certificate**

Written examination, 90 min

**Prerequisites**

none

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

#### Fundamentals of Energy Technology

**2130927, SS 2024, 3 SWS, Language: German, Open in study portal**

**Lecture (V) On-Site**

**Content**

The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:

- Energy demand and energy situation  
- Energy types and energy mix  
- Basics. Thermodynamics relevant to the energy sector  
- Conventional fossil-fired power plants  
- Combined Cycle Power Plants  
- Cogeneration  
- Nuclear energy  
- Regenerative energies: hydropower, wind energy, solar energy, other energy systems  
- Energy storage  
- Transport of energy  
- Power generation and environment. Future of the energy industry
The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy forms
- Thermodynamics relevant to energy industry
- Energy sources: fossil fuels, nuclear energy, renewable sources
- Energy industry in Germany, Europe and worldwide
- Power generation and environment
- Evaluation of energy conversion processes
- Thermal/electrical power plants and processes
- Transport of energy / energy carriers
- Energy storage
- Systems utilizing renewable energy sources
- Basics of economic efficiency and calculus / Optimisation
- Future of the energy industry
## 3.143 Course: Fundamentals of Reactor Safety for the Operation and Dismantling of Nuclear Power Plants [T-MACH-105530]

**Responsible:** Dr. Victor Hugo Sanchez-Espinoza  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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### Exams

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**Competence Certificate**

oral exam about 30 minutes

**Prerequisites**

none
### 3.144 Course: Fusion Technology A [T-MACH-105411]

**Responsible:** N.N.  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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#### Events

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<th>Credits</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>Lecture / Practice (VÜ)</td>
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<td>2 SWS</td>
<td>Practice</td>
<td>Steiglitz, Day, Weiss</td>
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#### Exams

| WT 23/24 | 76-T-MACH-105411 | Fusion Technology A | Day, Weiss |

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

#### Competence Certificate

oral exam of about 30 minutes

#### Prerequisites

none

#### Recommendation

appreciated is knowledge in heat and mass transfer as well as in electrical engineering, basic knowledge in fluid mechanics, material sciences and physics

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

**Fusion Technology A**  
2169483, WS 23/24, 2 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**  
On-Site

#### Content

To transfer the basic physical concepts of particle physics, fusion and nuclear fission; this includes fundamental questions such as how: What is a plasma? How can it be ignited? What is the difference between magnetic and inertial fusion? Based on this, aspects of the stability of plasmas, their control and particle transport are discussed. After characterizing the plasma, the "fire" of fusion, the confinement in magnetic fields is sketched, which are built up with the help of magnetic technology. Here, knowledge of superconductivity, production and design of magnets is imparted. A reactor operation with a plasma as energy source requires a continuous operation of a tritium and fuel cycle, which is generated by the fusion reactor itself. Since fusion plasmas require small material densities, vacuum technology plays a central role. Finally, the heat generated in the fusion power plant must be converted into a power plant process and the reaction products removed. The functional basics and the structure of these fusion-typical in-vessel components are presented and the current challenges and the state of the art are demonstrated.

The course describes the essential functional principles of a fusion reactor, beginning with plasma, magnet technology, the tritium and fuel cycle, vacuum technology and the associated material sciences. The physical basics will be taught and the engineering laws of scaling will be demonstrated. Special importance is attached to the understanding of the interfaces between the different subject areas, which essentially determine the engineering technical interpretations. Methods for identifying and evaluating the central parameters will be demonstrated. Based on the acquired perception skills, methods for the design of solution strategies will be taught and technical solutions will be identified, their weak points discussed and evaluated.

#### Recommendations/Pre-knowledge:

Basic knowledge of fluid mechanics, materials engineering and physics. Knowledge of heat and mass transfer and electrical engineering is helpful.

Presence time: 21 h  
Self-study: 90 h  
Oral examination:  
Duration: approx. 30 minutes, aids: none
Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
Innerhalb jedes Teilblockes wird eine Literaturliste der jeweiligen Fachliteratur angegeben. Zusätzlich erhalten die Studenten/-innen das Studienmaterial in gedruckter und elektronischer Version.
3.145 Course: Fusion Technology B [T-MACH-105433]

**Responsible:** N.N.

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<tr>
<th>Type</th>
<th>Credits</th>
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**Events**

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Legend: 📥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam of about 30 minutes

**Prerequisites**

none

**Recommendation**

attendance of fusion technology A lecture

reliable capability to use fundamental knowledge communicated in the bachelor study in physics, material sciences, electrical engineering and engineering design

**Annotation**

none
**3.146 Course: Gear Cutting Technology [T-MACH-102148]**

**Responsible:** Hon.-Prof. Dr. Markus Klaiber  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>2 SWS</td>
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Legend: 🖥 Online, 🟢 Blended (On-Site/Online), 🔗 On-Site, ⚤ Cancelled

**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

none

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

**Gear Technology**

2149655, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

**Learning Outcomes:**

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

**Workload:**

regular attendance: 21 hours
self-study: 99 hours

**Literature**

Medien:

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

Media:

Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).
3.147 Course: Global Logistics [T-MACH-105379]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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</tr>
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<td>4</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

<table>
<thead>
<tr>
<th>ST 2024</th>
<th>3118095</th>
<th>Global Logistics</th>
<th>2 SWS</th>
<th>Furmans, Kivelä, Jacobi</th>
</tr>
</thead>
</table>

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

**Competence Certificate**

oral exam (approx. 20 min)

**Prerequisites**

none

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

**Global Logistics**

3118095, SS 2024, 2 SWS, Language: English, [Open in study portal](#) Blended (On-Site/Online)
Content
Conveyor Systems
- Basic elements of conveyor systems
- Key figures
- Branching elements
- continuous/partially-continuous
- deterministic/stochastic switch
- Integration elements
- continuous/partially-continuous
- dispatching rules

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

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

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

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

Organizational issues
Attendance during lecture is required. Admission to the exam is only possible when attending the lecture.

Literature
Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg
3 COURSES

Course: Global Production and Logistics - Part 1: Global Production [T-MACH-105158]

3.148 Course: Global Production and Logistics - Part 1: Global Production [T-MACH-105158]

| Responsible: | Prof. Dr.-Ing. Gisela Lanza |
| Organisation: | KIT Department of Mechanical Engineering |
| Part of: | M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering |

<table>
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**Events**

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<td>Lecture</td>
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**Exams**

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<tbody>
<tr>
<td>Lecture</td>
<td>76-T-MACH-110991</td>
<td>WS 23/24</td>
<td>German</td>
<td>On-Site/Online</td>
</tr>
</tbody>
</table>

**Prerequisites**

"T-MACH-108848 - Globale Produktion und Logistik - Teil 1: Globale Produktion" must not be commenced.

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

**Global Production**

<table>
<thead>
<tr>
<th>Code</th>
<th>WS 23/24</th>
<th>Language</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2149613</td>
<td>2 SWS, Online</td>
<td>On-Site/Online</td>
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</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
Content
The lecture examines the management of global production networks of manufacturing companies. It gives an overview of the influencing factors and challenges of global production. In-depth knowledge of common methods and procedures for planning, designing and managing global production networks is imparted.

Therefore, the lecture first of all discusses the connections and interdependencies between the business strategy and the production strategy and illustrates necessary tasks for the definition of a production strategy. Methods for site selection, for the site-specific adaptation of product design and production technology as well as for the establishment of new production sites and for the adaptation of existing production networks to changing framework conditions are subsequently taught within the context of the design of the network footprint. With regard to the management of global production networks, the lecture addresses challenges associated with coordination, procurement and order management in global networks. The lecture is complemented by a discussion on the use of industry 4.0 applications in global production and current trends in planning, designing and managing global production networks.

The topics include:

• Basic conditions and influencing factors of global production (historical development, targets, chances and threats)
• Framework for planning, designing and managing global production networks
• Production strategies for global production networks
  ◦ From business strategy to production strategy
  ◦ Tasks of the production strategy (product portfolio management, circular economy, planning of production depth, production-related research and development)
• Design of global production networks
  ◦ Basic types of network structures
  ◦ Planning process for the design of the network footprint
  ◦ Adaptation of the network footprint
  ◦ Site selection
  ◦ Location-specific adaptation of production technology and product design
• Management of global production networks
  ◦ Network coordination
  ◦ Procurement process
  ◦ Order management
• Trends in planning, designing and managing global production networks

Learning Outcomes:
The students …

• can explain the general conditions and influencing factors of global production
• are capable to apply defined procedures for site selection and to evaluate site decisions with the help of different methods
• are able to select the adequate scope of design for site appropriate production and product construction case specifically
• can state the central elements in the planning process of establishing a new production site.
• are capable to make use of the methods to design and scale global production networks for company-individual problems
• are able to show up the challenges and potentials of the departments sales, procurement as well as research and development on global basis.

Workload:
regular attendance: 21 hours
self-study: 99 hours

Recommendations:
Combination with Global Production and Logistics – Part 2

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

Media
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/)
recommended secondary literature:
3.149 Course: Global Production and Logistics - Part 2: Global Logistics [T-MACH-105159]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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Events

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<td>2</td>
<td>Lecture / 🗣</td>
<td>Furmans</td>
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Exams

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<td>Global Production and Logistics - Part 2: Global Logistics / New: Global Logistics</td>
<td>Furmans</td>
</tr>
</tbody>
</table>

Competence Certificate
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

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

Global Logistics
2149600, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site
Content

Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies
- Inventory management considering lead time and shipping costs

Media:

presentations, black board

Workload:

regular attendance: 21 hours
self-study: 99 hours

Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with appropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Exam:

The exam consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).
The main exam is offered every summer semester. A second date for the exam is offered in winter semester only for students that did not pass the main exam.

Literature

Weiterführende Literatur:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren, Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, Oldenbourg Verlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
3.150 Course: Handling Characteristics of Motor Vehicles I [T-MACH-105152]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events

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<th>Recurrence</th>
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<td>2113807</td>
<td>Handling Characteristics of Motor Vehicles I</td>
<td>Lecture</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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Exams

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<td>Lecture</td>
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<td>Grade to a third</td>
<td>Each winter term</td>
<td>Unrau</td>
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Legend: 🏽 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⏿ Cancelled

Competence Certificate

Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites

none

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

Handling Characteristics of Motor Vehicles I

2113807, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content

1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

Learning Objectives:

The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation. Consequently they are ready to analyze the most important influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

Organizational issues

Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/Passwoerterilias/

Literature


3 COURSES

Course: Handling Characteristics of Motor Vehicles II [T-MACH-105153]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Version</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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Events

| ST 2024 | 2114838 | Handling Characteristics of Motor Vehicles II | 2 SWS | Lecture / 🖥 | Unrau |

Exams

| WT 23/24 | 76-T-MACH-105153 | Handling Characteristics of Motor Vehicles II | Unrau |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ☑ Cancelled

Competence Certificate

Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites

none

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

Handling Characteristics of Motor Vehicles II

2114838, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content

1. Vehicle handling: Bases, steady state cornering, steering input step, single sine, double track switching, slalom, cross-wind behavior, uneven roadway

2. Stability behavior: Basics, stability conditions for single vehicles and for vehicles with trailer

Learning Objectives:

The students have an overview of common test methods, with which the handling of vehicles is gauged. They are able to interpret results of different stationary and transient testing methods. Apart from the methods, with which e.g. the driveability in curves or the transient behavior from vehicles can be registered, also the influences from cross-wind and from uneven roadways on the handling characteristics are well known. They are familiar with the stability behavior from single vehicles and from vehicles with trailer. Consequently they are ready to judge the driving behaviour of vehicles and to change it by specific vehicle modifications.

Organizational issues

Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILIAS. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Literature

3.152 Course: Hands-on BioMEMS [T-MACH-106746]

**Responsible:** Prof. Dr. Andreas Guber

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each term</td>
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</table>

**Competence Certificate**
Oral presentation and discussion (30 Min.)

**Prerequisites**
none

**Responsible:** Prof. Dr. Ulrich Maas
Dr.-Ing. Chunkan Yu

**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Written examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each term  
**Version:** 1

<table>
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<th>Type</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Heat and transfer</td>
<td>Lecture /</td>
<td>Each term</td>
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<tr>
<td>ST 2024</td>
<td>2 SWS</td>
<td>Heat and Mass Transfer</td>
<td>Lecture /</td>
<td>Each term</td>
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<th>Version</th>
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<td>Heat and Mass Transfer</td>
<td>Lecture /</td>
<td>Each term</td>
<td>1</td>
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</table>

**Competence Certificate**

Written exam, approx. 3 h

**Prerequisites**

none

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

**Heat and mass transfer**

2165512, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Content**

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (condensation, evaporation)
- Radiative heat transfer

**Literature**

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"

**Heat and Mass Transfer**

3122512, SS 2024, 2 SWS, Language: English, [Open in study portal](#)

**Content**

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and sperical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (condensation, evaporation)
- Radiative heat transfer

**Organizational issues**

Bitte beachten Sie den Aushang.
Literature

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"
3.154 Course: Heat Transfer and Cooling at Thermally Highly Loaded Components [T-MACH-113362]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Achmed Schulz

Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

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

<table>
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<tbody>
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<td>4</td>
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Events

| ST 2024 | 2170466 | Heat Transfer and Cooling at Thermally Highly Loaded Components | 2 SWS | Lecture / 🗣 | Bauer, Schmid |

Exams

| ST 2024 | 76-T-MACH-113362 | Heat Transfer and Cooling at Thermally Highly Loaded Components | Schmid |

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

Competence Certificate
oral exam, approx. 30 min.

Annotation
Workload:
regular attendance: 30 h
self-study: 90 h

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

V Heat Transfer and Cooling at Thermally Highly Loaded Components
2170466, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site
Content

Teaching Content:
Thermally highly loaded components can be found in several fields of application: The hot gas temperatures of modern gas turbines and jet engines exceed the maximum tolerable temperatures by several hundreds of Kelvin. By increasing the power density of electric motors and the related power electronics in the field of e-mobility, the surface, available for lost heat rejection, is reduced. Furthermore, the temperature of the battery must be kept within a tight range to achieve an efficient operation. To ensure reliability of lifetime and operational safety, complex cooling technology must be applied.

First, the basics of forced convection and thermal radiation will be introduced in this lesson. Based on that various cooling methods will be presented. Specific pros and cons will be identified and new concepts for further improvement of cooling will be discussed. Subsequently, the capability of the introduced cooling methods is supported by practical applications. Finally, experimental and numerical methods for the characterization of heat transfer will be presented.

Workload:
regular attendance: 30 h
self-study: 90 h

Learning Objectives:
The students are able to:
- outline the basics of forced convection, thermal radiation and film cooling
- name, analyse and differentiate between different cooling methods
- judge the advantages and disadvantages of cooling methods and discuss approaches for the improvement of complex cooling methods
- design cooling concepts for thermally highly loaded components in a simplified manner
- name and rate the experimental and numerical methods for the characterisation of heat transfer

Exam:
oral exam, approximately 30 minutes, no tools or reference materials may be used during the exam

Language: German
3.155 Course: Heat Transfer in Nuclear Reactors [T-MACH-105529]

**Responsible:** Prof. Dr.-Ing. Xu Cheng  
**Organisation:** KIT Department of Mechanical Engineering

<table>
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<tr>
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**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Events**

<table>
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<tr>
<th>WT 23/24</th>
<th>2189907</th>
<th>Flow and heat transfer in nuclear reactors</th>
<th>2 SWS</th>
<th>Lecture / 🧩</th>
<th>Cheng</th>
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**Exams**

<table>
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<tr>
<th>WT 23/24</th>
<th>76-T-MACH-105529</th>
<th>Heat Transfer in Nuclear Reactors</th>
<th>Cheng</th>
</tr>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗂 On-Site, ❌ Cancelled

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none

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

**Flow and heat transfer in nuclear reactors**
2189907, WS 23/24, 2 SWS, Language: English, Open in study portal

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

**Content**
This lecture is designed for students of mechanical engineering and other engineering disciplines in their Bachelor or Master studies. The students will understand the most important heat transfer processes and learn the methods for the analysis of flow and heat transfer in nuclear reactors. Students are capable of explaining the thermal-hydraulic processes occurring in nuclear reactors and of selecting suitable models or simulation codes for thermal-hydraulic design and analysis.

1. Reactor types and thermal-hydraulic design criteria  
2. Heat transfer processes and modeling  
3. Pressure drop calculation  
4. Temperature distribution in nuclear reactor  
5. Numerical analysis methods for nuclear reactor thermal-hydraulics

**Organizational issues**
This compact English lecture will be given on February 19 - 21, 2023, 09:00-17:00.  
in seminar room of the Institute IATF, Building 07.08, Room 331

**Literature**
1. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA  
# 3.156 Course: Heatpumps [T-MACH-105430]

**Responsible:** Prof. Dr. Ulrich Maas  
Dr.-Ing. Heinrich Wirbser  

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
<thead>
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**Events**

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<th>Lecturer</th>
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<td>Lecture</td>
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**Exams**

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**Competence Certificate**

Oral exam (20 min)

**Prerequisites**

none

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

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### Content

The aim of this lecture is to promote heat pumps as heating systems for small and medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

**Literature**

Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979  

---

### Content

The aim of this lecture is to promote heat pumps as heating systems for small and medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.
Literature

Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979
3.157 Course: High Performance Computing [T-MACH-105398]

**Responsible:** Prof. Dr. Britta Nestler
Dr.-Ing. Michael Selzer

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>High Performance Computing</td>
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<td>Nestler, August, Selzer</td>
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</tbody>
</table>

**Competence Certificate**

At the end of the semester, there will be a written exam (90 min).

**Prerequisites**

none

**Recommendation**

preliminary knowledge in mathematics, physics and materials science

regular participation in the additionally offered computer exercises

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

**High Performance Computing**

2183721, WS 23/24, 2 SWS, Language: German, Open in study portal

<table>
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<th>Lecture / Practice (VÜ)</th>
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</thead>
<tbody>
<tr>
<td>On-Site</td>
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</tbody>
</table>
Content

PLEASE NOTE: This lecture is only offered in the winter semester!

Topics of the high performance computing course are:

- architectures of parallel platforms
- parallel programming models
- performance analysis of concurrent programs
- parallelization models
- MPI and OpenMP
- Monte-Carlo method
- 1D & 2D heat diffusion
- raycasting
- n-body problem
- simple phase-field models

The student

- can explain the foundations and strategies of parallel programming
- can efficiently apply high performance computers for simulations by elaborating respective parallelisation techniques.
- has an overview of typical applications and the specific requirements for parallelization.
- knows the concepts of parallelisation and is capable to apply these to efficiently use high performance computing resources and the growing performance of multi core processors in science and industry.
- has experiences in programming of parallel algorithms through integrated computer exercises.

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly discuss exercises at the computer.

At the end of the semester, there will be a written exam.

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007

**Responsible:** apl. Prof. Dr. Günter Schell  
**Organisation:** KIT Department of Mechanical Engineering

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

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**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 1

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### Events

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### Exams

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

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**Competence Certificate**

oral exam, 20-30 min

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**Prerequisites**

none

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

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### Advanced powder metals

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online)

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**Literature**

- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005  
Course: High Temperature Materials [T-MACH-105459]

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

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

**Type:** Oral examination
**Credits:** 4
**Grading scale:** Grade to a third
**Recurrence:** Each winter term
**Version:** 2

**Events**
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**Competence Certificate**
Oral exam, about 25 minutes

**Prerequisites**
none

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

### High Temperature Materials
**2174605, WS 23/24, 2 SWS, Language: English, Open in study portal**

**Lecture (V)**
On-Site

**Content**
- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

**learning objectives:**
Students are able to
- Define properly the term "high temperature" with respect to materials
- Describe the shape of the creep curve based on underlying deformation mechanisms
- Rationalize the influence of relevant parameters such as temperature, stress, microstructure on the high temperature deformation behavior
- Develop strategies for improving creep resistance of alloys via modifying their composition
- Select properly industrially relevant high temperature structural materials for various applications

**Literature**
B. Ilschner, Hochtemperaturplastizität, Springer-Verlag, Berlin
Course: Holistic Approach of Managing Power Plant Operation under Uncertainty and Volatility [T-MACH-112238]

**Responsible:** Dr. Marcus Seidl  
**Organisation:** KIT Department of Mechanical Engineering

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

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**Competence Certificate**

oral exam of about 30 minutes

**Prerequisites**

none

**Annotation**

none

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

**Holistic approach of managing power plant operation under uncertainty and volatility**

2189405, WS 23/24, 2 SWS, Language: English, Open in study portal
Content
Main Contents:
The structure of electricity markets
Requirements from network operators
The basics of commodity markets
The impact of regulation on power plant operation
The role of behavioral economics in power plant decision making
Integration of renewable energy sources into the electricity market
Calibration of power plant operation and maintenance to market requirements
Asset management for power plant fleets
Applying financial engineering to optimize asset utilization
Day-to-day decision making for power plant operation

The lecture provides an overview of the many practical aspects of power plant operation. For this purpose, the knowledge of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance are required.

For the purpose of an efficient management of a power plant fleet it is explained how a variety of statistical models can be used to determine the optimal combination of resource purchases, outage management, load availability and ask prices.

Each credit point equals to 25-30 h working time of a student. Thereby, the time is based on an average student finishing with and average score. The working time can be split into: 1 attendance of the lectures, 2. pre- and post-processing of the lecture, 3 preparations for examination.

Students understand the many aspects of power plant operation: the structure of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance.

Furthermore, students can develop on their own a suitable strategy for the management of a power plant fleet.

Oral exam of about 25 min.

Literature
G. Balzer, C. Schorn, Asset Management für Infrastruktur anlagen - Energie und Wasser, VDI
R. Weron, Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach, Wiley
3.161 Course: Homework 'Basics of Finite Elements' [T-BGU-109908]

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

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Events

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Exams

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔅 On-Site, ✗ Cancelled

Competence Certificate
processing of three exercise sheets

Prerequisites
none

Recommendation
none

Annotation
none
**Course: Human Factors Engineering I [T-MACH-105518]**

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

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

<table>
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**Events**

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<td>Lecture</td>
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<td>Lecture</td>
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**Competence Certificate**

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

**Prerequisites**

none

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

**Human Factors Engineering I: Ergonomics**

2109035, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V) On-Site**

**Content**

The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester on Wednesday and Thursday.

In the second half of the semester the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:

1. Principles of human work  
2. Behavioural-science data acquisition  
3. workplace design  
4. work environment design  
5. work management  
6. labour law and advocacy groups

**Learning target:**

The students acquire a basic knowledge in the field of ergonomics:

- They are able to consider cognitive, physiological, anthropometric, and safety technical aspects in order to design workplaces ergonomically.
- Just as well they know physical and psycho-physical fundamentals (e.g. noise, lighting, climate) in the field of work-environmental design.
- Furthermore the students are able to evaluate workplaces by knowing and being able to apply essential methods of time studies and payment systems.
- Finally, they get a first, overall insight into the German labour law as well as into the organisation of advocacy groups beyond companies.

Further on the participants get to know basic methods of behavioral-science data acquisition (e.g. eye-tracking, ECG, dual-task-paradigm).
Organizational issues
- schriftliche Prüfung
- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

Mit einer gültigen KIT-E-Mail-Adresse können Sie das Passwort bei elisabeth.schlund@kit.edu schriftlich erfragen.

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.
3.163 Course: Human Factors Engineering II [T-MACH-105519]

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

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

<table>
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Events

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

Prerequisites
none

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

Human Factors Engineering II: Work Organisation
2109036, WS 23/24, 2 SWS, Language: German, [Open in study portal]

Lecture (V)
On-Site
Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester on Wednesday and Thursday.

In the second half of the semester the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:
1. Fundamentals of work organization
2. Empirical research methods
3. Individual level
   ◦ personnel selection
   ◦ personnel development
   ◦ personnel assessment
   ◦ work satisfaction/motivation
4. Group level
   ◦ interaction and communication
   ◦ management of employees
   ◦ team work
5. Organizational level
   ◦ structural organization
   ◦ process organization
   ◦ production organization

Learning target:
The students gain a first insight into empirical research methods (e. g. experimental design, statistical data evaluation). Particularly, they acquire a basic knowledge in the field of work organisation:

• **Organizational level.** Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization.
• **Group level.** Besides, they get to know basic aspects of industrial teamwork and they know relevant theories in the field of interaction and communication, the management of employees as well as work satisfaction and motivation.
• **individual level.** Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

Organizational issues
Die Veranstaltung "Arbeitswissenschaft I: Ergonomie" findet in der ersten Hälfte des Semesters am Mittwoch und Donnerstag statt.

In der zweiten Hälfte, ab dem Donnerstag, dem 21.12.2023 findet die Veranstaltung "Arbeitswissenschaft II: Arbeitsorganisation" am Mittwoch und Donnerstag statt.

- schriftliche Prüfung
- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

**Mit einer gültigen KIT-E-Mail-Adresse können Sie das Passwort bei elisabeth.schlund@kit.edu schriftlich erfragen.**

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

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

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

<table>
<thead>
<tr>
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<td>2 SWS</td>
<td>Practical course / On-Site</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate  
Scientific report (about 6 pages), poster, and presentation

Prerequisites  
In order to attend this lecture, it is necessary having completed "Arbeitswissenschaft I" or "Arbeitswissenschaft II" successfully.

Modeled Conditions  
You have to fulfill one of 2 conditions:

1. The course T-MACH-105518 - Human Factors Engineering I must have been passed.
2. The course T-MACH-105519 - Human Factors Engineering II must have been passed.

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

Human Factors Engineering III: Empirical research methods  
2110036, SS 2024, 2 SWS, Language: German, Open in study portal

Practical course (P)  
On-Site

Content  
The aim of the course is for participants to become familiar with and apply research methods in occupational science. For this purpose, the participants will receive an introduction to the basics of experimental design and they will learn essential methods of data collection and statistical data analysis. Subsequently, the participants will conduct, evaluate and present their own experimental studies on the topics of driver behavior and driving simulation. Weekly face-to-face attendance at lecture sessions as well as small group sessions in the lab is mandatory.

In addition, an approximately six-page research report and presentation are required as part of the course.

Organizational issues
### 3.165 Course: Human-Machine-Interaction [T-INFO-101266]

**Responsible:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

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

**Prerequisites**

none
3.166 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

Responsible: Prof. Dr. Martin Doppelbauer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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Prerequisites

none
3.167 Course: Hydraulic Fluid Machinery [T-MACH-105326]

**Responsible:** Dr. Balazs Pritz  
**Organisation:** KIT Department of Mechanical Engineering  
Institute of Thermal Turbomachinery  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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

**Competence Certificate**

oral exam, 40 min.

**Prerequisites**

None.

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

**Hydraulic Fluid Machinery**

2157432, SS 2024, 4 SWS, Language: German, Open in study portal

**Lecture (V)**

On-Site

**Content**

1. Introduction  
2. Basic equations  
3. System analysis  
4. Elementary Theory (Euler's equation of Fluid Machinery)  
5. Operation and Performance Characteristics  
6. Similarities, Specific Values  
7. Control technics  
8. Wind Turbines, Propellers  
9. Cavitation

**Recommendations:**

3154510 – Fluid Mechanics I  
3153511 – Fluid Mechanics II

Students get to know the basics of hydraulic fluid machinery (pumps, fans, hydroturbines, windturbines, hydrodynamic transmissions) in general. Application of the knowledge in different fields of engineering.

The lecture introduces the basics of Hydraulic Fluid Machinery. The different types and shapes are presented. The basic equations for the preservation of mass, momentum and energy are discussed. Velocity schemes in typical cascades are shown, the Euler equation of fluid machinery and performance characteristics are deduced.

Similarities and dimensionless parameters are discussed. Fundamental aspects of operation and cavitation are shown.

Students are able to understand the working principle of Hydraulic Fluid Machinery as well as the interaction with typical systems, in which they are integrated.

regular attendance: 56 hours  
self-study: 150 hours  
preparation for exam: 40 hours  
Oral or written examination (see announcement)

No tools or reference materials may be used during the exam.
Literature

1. Fister, W.: Fluidenergiemaschinen I & II, Springer-Verlag
2. Bohl, W.: Strömungsmaschinen I & II, Vogel-Verlag
3. Güllich, J.F.: Kreiselpumpen, Springer-Verlag
5. Carolus, T.: Ventilatoren, Teubner-Verlag
6. Kreiselpumpenlexikon, KSB Aktiengesellschaft
7. Zierep, J., Bühl, K.: Grundzüge der Strömungslehre, Teubner-Verlag
3.168 Course: Hydrogen as Energy Carrier [T-CHEMBIO-112317]

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

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Exams

| WT 23/24 | 7100039 | Hydrogen as Energy Carrier | Ehrenberg |

Competence Certificate
Oral exam, about 25 minutes
Responsible: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Type**
Completed coursework

**Credits**
4

**Grading scale**
pass/fail

**Recurrence**
Each summer term

**Expansion**
1 terms

**Version**
2

**Competence Certificate**
Regular participation and participating in lab course, protocol included.

**Prerequisites**
none

Responsible: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Exams
WT 23/24 76-T-MACH-110923 Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement Pundt

Competence Certificate
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

Annotation
in English
3.171 Course: Hydrogen Technologies [T-MACH-105416]

Responsible: Olaf Jedicke
Dr. Thomas Jordan

Organisation: KIT Department of Mechanical Engineering

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

Type: Written examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 2

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

Competence Certificate
Written exam, Duration: 90 minutes
Auxiliary: no tools or reference materials may be used during the exam

Prerequisites
none

Recommendation
Fundamentals Thermodynamics

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

Hydrogen Technologies
2170495, SS 2024, 2 SWS, Language: German, Open in study portal

Content
The course content is the cross-cutting issue of hydrogen as energy carrier. After successful participation the students may reflect on the fundamental technological basis of an energy system using predominantly hydrogen as an energy carrier or energy storage. Based on this knowledge they may objectify the principle idea of an hydrogen economy.

The students know the fundamental physical and chemical properties of hydrogen and may apply their knowledge on thermodynamics to compare efficiencies of different solutions with hydrogen. They can list, compare and evaluate established and future solutions for production, storage and distribution of hydrogen. They can explain advantages and disadvantages of using hydrogen in conventional combustion processes versus using hydrogen in different fuel cells. In particular the can describe the specific safety aspects related to hydrogen, compare them with other energy vectors and evaluate different measures for risk mitigation.

- Basic concepts
- Production
- Transport and storage
- Application
- Safety aspects

Literature
Ullmann's Encyclopedia of Industrial Chemistry
3.172 Course: Industrial Aerodynamics [T-MACH-105375]

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel  
Dr.-Ing. Stefan Kröber

**Organisation:** KIT Department of Mechanical Engineering

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

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**Competence Certificate**

oral exam - 30 minutes

**Prerequisites**

none

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

### Industrial aerodynamics

2153425, WS 23/24, 2 SWS, Language: German, Open in study portal

Blended (On-Site/Online)

**Content**

This compact lecture deals with flows and aeroacoustics with significance in vehicle development. A special focus is set on the optimization of external vehicle aerodynamics and the presentation of modern industrial wind tunnel technology. The second major thematic block includes both, aeroacoustic basics principles and practical examples of aeroacoustics, especially in the field of automotive technology. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. This lecture focusses on industry relevant methods for analyses and descriptions of forces, aeroacoustic sound fields, flow structures and turbulence. In addition, an overview of numerical methods for industrial applications is given. The integration and interconnection of the methods in the development processes are discussed exemplary.

An excursion to the Mercedes-Benz AG wind tunnel and the research and development centers is planned.

- Introduction
- Aerodynamics of bluff bodies
- Industrial flow measurement techniques and modern wind tunnel technology
- Overview of flow simulation in automotive industry
- Vehicle aerodynamics
- Passenger comfort of roadsters and cabriolets
- Soiling of road vehicles
- Aeroacoustics: basic principles and practical examples of aeroacoustics, especially in the field of automotive technology including aeroacoustic measurement techniques and numerical methods

Students can describe the different properties of aerodynamics and aeroacoustics of vehicles flows. They are qualified to analyze external flows around the vehicles and aeroacoustic sound fields of vehicles.

**Organizational issues**

Blockvorlesung - Anmeldung erfolgt über das Sekretariat, max. Teilnehmerzahl sind 20 Studierende.

**Literature**

Vorlesungsskript
### 3.173 Course: Industrial Circuitry [T-ETIT-100716]

**Responsible:** Dr.-Ing. Andreas Liske  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology  

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

**Prerequisites**

none
3.174 Course: Information Processing in Sensor Networks [T-INFO-101466]

Responsible:  Prof. Dr.-Ing. Uwe Hanebeck
Organisation:  KIT Department of Informatics
Part of:  M-MACH-104883 - Courses of the KIT Department of Informatics

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3.175 Course: Information Systems and Supply Chain Management [T-MACH-102128]

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

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

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Competence Certificate
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites
none
3.176 Course: Innovation and Project Management in Rail Vehicle Engineering [T-MACH-113068]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

- **WT 23/24**
  - Exam code: 76-T-MACH-106427
  - Name: Innovation and Project Management in Rail Vehicle Engineering
  - Instructor: Cichon

- **ST 2024**
  - Exam code: 76-T-MACH-106427
  - Name: Innovation and Project Management in Rail Vehicle Engineering
  - Instructor: Cichon

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

**Competence Certificate**

- Presentation (duration approx. 20 minutes) and colloquium
Course: Innovation2Business – Innovation Strategy in the Industrial Corporate Practice [T-MACH-112882]

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

### Course Details

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<td>Innovation2Business – innovation strategy in the industrial corporate practice</td>
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<td>Albers</td>
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</tbody>
</table>

**Competence Certificate**

Written exam based on the lecture handout and materials, duration 90 minutes

**Prerequisites**

none

**Recommendation**

None

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

**Innovation2Business – Innovation Strategy in the Industrial Corporate Practice**  
Lecture (V)  
2145182, WS 23/24, 2 SWS, Language: German/English, [Open in study portal]

**Content**

2 lecture blocks at the Bühl & Herzogenaurach locations with plant tours & fireside evenings + exam-preparatory Q&A.  
Exam: written, limited to 40 seats (recommended for: Master's degree; mechanical engineering, industrial engineering, electrical engineering, computer science) → see module manual for details.  
In this lecture series, use Schaeffler as an example to learn how global companies continuously transform themselves to grow sustainably and become maintain a leading position in the global market in the long term through business-oriented innovation.  
Together we will go through the most important elements of the innovation and development process and learn about the successes and learnings based on vivid examples from practice.  
Join the fireside evenings with the speakers to discuss the lecture content and beyond in a relaxed atmosphere.  
The event is limited to 40 students and is free for you (meals, bus transfers & accommodations).

**Organizational issues**

Sprache: Unterlagen Englisch, Vortragssprache Deutsch

**Literature**

Vorlesungsumdruck
Course: Innovative Nuclear Systems [T-MACH-105404]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

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

<table>
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<th>Credits</th>
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<td>Each summer term</td>
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<td>Innovative Nuclear Systems</td>
<td>2 SWS</td>
<td>/ 🗣</td>
<td>Cheng</td>
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</table>

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

Competence Certificate
oral exam, 20 min

Prerequisites
none

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

**Innovative Nuclear Systems**
2130973, SS 2024, 2 SWS, Language: German, Open in study portal

Content
This lecture is addressed to students of mechanical engineering, chemical engineering and physics. Goal of the lecture is the explanation of state-of-the-art development of nuclear systems. Nuclear systems, that are from today's point of view promising will be presented and explained. The main characteristics of such systems and the associated challenges are also part of the lecture.

1. state of the art and development tendencies in nuclear systems
2. advanced concepts in light water cooled systems
3. new developments in fast reactors
4. development tendencies in gas-cooled plants
5. transmutation systems for waste management
6. fusionsystems

Organizational issues
Geb. 07.08, SR 331
Mo (29.07.2024), 09:00 bis 17:00
Di (30.07.2024), 09:00 bis 17:00
Mi (31.07.2024), 09:00 bis 17:00
# Course: Innovative Project [T-MACH-109185]

**Responsible:** apl. Prof. Dr. Andreas Class  
Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Exams**

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<td>Innovative Project</td>
<td>Class, Terzidis</td>
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**Competence Certificate**

Students have to deliver pitch-talk supported by slides to convince a commity about their results. A fictive project proposal of 10 to 15 pages.

**Prerequisites**

None

**Recommendation**

Participates need to bring there own laptop with Skype installed.

Recommended English proficiency equivalent to:

- **IELTS Academic test**  
  An overall band score of at least 6.5 (with no section lower than 5.5)

- **University of Cambridge**  
  Certificate in Advanced English, CAE (grades A – C)
  Certificate of Proficiency in English, CPE (grades A – C)

- **TOEFL Internet-based test, IBT**  
  A total score of at least 92, with a minimum score of 22 from the writing section

**Annotation**

The subject of the project is provided by industry partner or the innovation department from KIT or INP Grenoble. Representatives of industry partner will be addressee for the pitch-talk.
### 3.180 Course: Integrated Information Systems for Engineers [T-MACH-102083]

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

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

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<td>🗣️</td>
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<td>Ovtcharova, Elstermann</td>
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**Exams**

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</table>

**Competence Certificate**

Oral examination 20 min.

**Prerequisites**

None

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

### Integrated Information Systems for engineers

**2121001, WS 23/24, 3 SWS, Language: German, Open in study portal**

**Lecture / Practice (VÜ) On-Site**

**Content**

- Information systems, information management
- CAD, CAP and CAM systems
- PPS, ERP and PDM systems
- Knowledge management and ontology
- Process modeling

**Students can:**

- illustrate the structure and operating mode of information systems
- describe the structure of relational databases
- describe the fundamentals of knowledge management and its application in engineering and deploy ontology as knowledge representation
- describe different types of process modelling and their application and illustrate and execute simple work flows and processes with selected tools
- explain different goals of specific IT systems in product development (CAD, CAP, CAM, PPS, ERP, PDM) and assign product development processes

**Literature**

Vorlesungsfolien / lecture slides

### Integrated Information Systems for engineers

**2121001, SS 2024, 3 SWS, Language: German, Open in study portal**

**Lecture / Practice (VÜ) On-Site**
Content

- Information systems, information management
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- explain different goals of specific IT systems in product development (CAD, CAP, CAM, PPS, ERP, PDM) and assign product development processes

Literature

Vorlesungsfolien / lecture slides


3.181 Course: Integrated Production Planning in the Age of Industry 4.0 [T-MACH-108849]

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

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

<table>
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**Events**

| ST 2024 | 2150660 | Integrated Production Planning in the Age of Industry 4.0 | 6 SWS | Lecture / Practice (VÜ) / Lanza |

**Exams**

| WT 23/24 | 76-T-MACH-108849 | Integrated Production Planning in the Age of Industry 4.0 | Lanza |

Legends: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled

**Competence Certificate**

Oral Exam (40 min)

**Prerequisites**

"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

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

**Integrated Production Planning in the Age of Industry 4.0**

2150660, SS 2024, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ) On-Site

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)  
Module Handbook as of 23/02/2024
**Content**

Integrated Production Planning in the age of Industry 4.0 will be taught in the context of this engineering science lecture. In addition to a comprehensive introduction to Industry 4.0, the following topics will be addressed at the beginning of the lecture:

- Basics, history and temporal development of production
- Integrated production planning and integrated digital engineering
- Principles of integrated production systems and further development with Industry 4.0

Building on this, the phases of integrated production planning are taught in accordance with VDI Guideline 5200, whereby special features of parts production and assembly are dealt with in the context of case studies:

- Factory planning system
- Definition of objectives
- Data collection and analysis
- Concept planning (structural development, structural dimensioning and rough layout)
- Detailed planning (PPS, process simulation as a validation tool, planning of conveyor technology and storage systems for linking production and IT systems in the I4.0 factory)
- Preparation and monitoring of implementation
- Start-up and series support

The lecture contents are complemented by numerous current practical examples with a strong Industry 4.0 reference. Aspects of sustainability are anchored in all units and thus basic knowledge of sustainable production planning is taught. Within the exercises the lecture contents are deepened and applied to specific problems and tasks.

**Learning Outcomes:**

The students …

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.
- know the basic features of sustainable production planning and can apply underlying knowledge.

**Workload:**

**MACH:**
regular attendance: 63 hours
self-study: 177 hours

**WING:**
regular attendance: 63 hours
self-study: 207 hours

**Organizational issues**

Vorlesungstermine dienstags 14.00 Uhr und donnerstags 14.00 Uhr, Übungstermine donnerstags 15.45 Uhr. Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung

**Literature**

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

**Media:**
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).
3.182 Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

**Responsible:** Karl-Hubert Schlichtenmayer

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<td>2 SWS</td>
<td>Lecture / 🗣️</td>
<td>Schlichtenmayer</td>
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**Exams**

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

**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**Integrative Strategies in Production and Development of High Performance Cars Lecture (V)**

2150601, SS 2024, 2 SWS, Language: German, [Open in study portal](#)
Content
The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.
The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Learning Outcomes:
The students …

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Workload:
regular attendance: 21 hours
self-study: 99 hours

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

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).
3.183 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

**Responsible:** Prof. Dr.-Ing. Tobias Düser
Dipl.-Ing. Frank Zacharias

**Organisation:** KIT Department of Mechanical Engineering

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

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<td>ST 2024</td>
<td>2147160</td>
<td>Patents and Patentstrategies in innovative companies</td>
<td>2 SWS</td>
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**Exams**

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<td>Zacharias, Albers</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, 🗑 Cancelled

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

**Prerequisites**
none

**Recommendation**
None

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

**Intellectual Property Rights and Strategies in Industrial Companies**
2147161, WS 23/24, 2 SWS, Language: German, Open in study portal
Content
Attendance at lectures (5 L): 24h
Personal preparation and follow-up of lecture and exercise: 5h
Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

The lecture will describe the requirements to be fulfilled and how protection is obtained for patents, design rights and trademarks, with a particular focus on Germany, Europe and the EU. Active, project-integrated intellectual property management and the use of strategic patenting by technologically oriented companies will also be discussed. Furthermore, the significance of innovations and intellectual property for both business and industry will be demonstrated using practical examples, before going on to consider the international challenges posed by intellectual property and current trends in the sector. Within the context of licensing and infringement, insight will be provided as to the relevance of communication, professional negotiations and dispute resolution procedures, such as mediation for example. The final item on the agenda will cover those aspects of corporate law that are relevant to intellectual property.

Lecture overview:
1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law

Organizational issues
Weitere Informationen siehe IPEK-Homepage.
https://www.ipek.kit.edu/2976_2858.php
Content

Attendance at lectures (5 L): 24h

Personal preparation and follow-up of lecture and exercise: 5h

Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

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Lecture overview:

1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law
### 3.184 Course: Introduction into Mechatronics [T-MACH-100535]

**Responsible:** Moritz Böhland  
apl. Prof. Dr. Markus Reischl  

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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**Exams**

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**Legend:**  
🖥 Online  
🧩 Blended (On-Site/Online)  
🗣 On-Site  
🗙 Cancelled

**Competence Certificate**

Oral exam (Duration: 2h)

**Prerequisites**

none

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

#### Introduction into Mechatronics

2105011, WS 23/24, 3 SWS, Language: German, [Open in study portal](#)

**Learning objectives:**

The student has knowledge about the specific challenge of interdisciplinary collaboration within the framework of mechatronics. He is able to explain the origin, necessity and methodic implementation of interdisciplinary collaboration, to name the main difficulties as well as the special features within the development of mechatronic products from the point of view of development methodic.

The student has fundamental knowledge of modeling mechanical, hydraulically and electrically part systems and about suitable optimization methods.

The student knows the difference in use of the term "system" in mechatronic and mechanical use.

**Literature**

Course: Introduction to Bionics [T-MACH-111807]

**Responsible:** apl. Prof. Dr. Hendrik Hölscher

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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### Events

| ST 2024 | 2142151 | Introduction to Biomimetics | 2 SWS | Lecture / Hölscher, Greiner |

<table>
<thead>
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<th>Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24</td>
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</tbody>
</table>

**Competence Certificate**

written exam (duration: 60 minutes)

**Prerequisites**
none

**Annotation**

Brick T-MACH-102172 may not be started

---

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

**Introduction to Biomimetics**

2142151, SS 2024, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

On-Site

### Content

Bionics focuses on the design of technical products following the example of nature. For this purpose we have to learn from nature and to understand its basic design rules. Therefore, the lecture focuses on the analysis of the fascinating effects used by many plants and animals. Possible implementations into technical products are discussed in the end.

The students should be able analyze, judge, plan and develop biomimetic strategies and products.

Basic knowledge in physics and chemistry

The successfull attendence 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.
### 3.186 Course: Introduction to Ceramics [T-MACH-100287]

**Responsible:** apl. Prof. Dr. Günter Schell  
**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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#### Events

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#### Exams

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

#### Competence Certificate

The assessment consists of an oral exam (30 min) taking place at a specific date. The re-examination is offered at a specific date.

#### Prerequisites

None

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

**Introduction to Ceramics**  
2125757, WS 23/24, 3 SWS, Language: German, [Open in study portal](#)

**Literature**

- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley  
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley  
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier
3 COURSES

Course: Introduction to Engineering Mechanics I: Statics [T-MACH-108808]


**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**

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<td>ST 2024</td>
<td>2162238</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials</td>
<td>2</td>
<td>Lecture / 🗣️</td>
<td>Römer</td>
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**Exams**

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<td>Introduction to Engineering Mechanics I: Statics</td>
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</table>

**Competence Certificate**

The assessment consists of a written examination taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Permitted utilities:** none

**Prerequisites**

None

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

**Introduction to Engineering Mechanics I: Statics and Strength of Materials**

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<td>Lecture (V) On-Site</td>
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**Content**

Statics: force · moment · general equilibrium conditions · center of mass · inner force in structure · plane frameworks · theory of adhesion
### Course: Introduction to Engineering Mechanics I: Statics and Strength of Materials [T-MACH-102208]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>2</td>
<td>Lecture / 🗣️</td>
<td>Römer</td>
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<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)</td>
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<td>Practice / 🧩</td>
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#### Exams

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<th>Duration</th>
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<td>WT 23/24</td>
<td>76-T-MACH-102208-2</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials (120min)</td>
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<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials (120 Min)</td>
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**Legend:** 🎷 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ☑️ Cancelled

### Competence Certificate

The assessment consists of a written examination (120 min) taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at every ordinary examination date.

For students of economics the assessment consists of a written examination (Statics - 75 min.)

Permitted utilities: non-programmable calculator

### Prerequisites

None

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

#### Introduction to Engineering Mechanics I: Statics and Strength of Materials

2162238, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V) On-Site**

### Content

Statics: force · moment · general equilibrium conditions · center of mass · inner force in structure · plane frameworks · theory of adhesion
3.189 Course: Introduction to Industrial Production Economics [T-MACH-105388]

**Responsible:** Simone Dürrschnabel

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Competence Certificate**

oral exam (approx. 30 min)

The exam is offered in German only!

**Prerequisites**

none
3.190 Course: Introduction to Microsystem Technology I [T-MACH-105182]

**Responsible:**
Dr. Vlad Badilita  
Dr. Mazin Jouda  
Prof. Dr. Jan Gerrit Korvink

**Organisation:**
KIT Department of Mechanical Engineering

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

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**Events**

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<td>Introduction to Microsystem Technology I</td>
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**Exams**

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<th>Code</th>
<th>Event Name</th>
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<td>Introduction to Microsystem Technology I</td>
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<td>Korvink, Badilita</td>
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</table>

**ST 2024**

SL 2024 76-T-MACH-105182 Introduction to Microsystem Technology I Korvink, Badilita

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

**Competence Certificate**
written examination (60 min)

**Prerequisites**
none

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

**Introduction to Microsystem Technology I**
2141861, WS 23/24, 2 SWS, Language: English, Open in study portal

**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
**3.191 Course: Introduction to Microsystem Technology II [T-MACH-105183]**

**Responsible:** Dr. Mazin Jouda  
Prof. Dr. Jan Gerrit Korvink  

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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**Events**

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<th>Credit</th>
<th>Module</th>
<th>Time</th>
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<td>2 SWS</td>
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**Exams**

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</table>

**Competence Certificate**

written examination (60 min)

**Prerequisites**

none

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

**Introduction to Microsystem Technology II**

2142874, SS 2024, 2 SWS, Language: English, [Open in study portal](#)

**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
3.192 Course: Introduction to Multi-Body Dynamics [T-MACH-105209]

**Responsible:** Dr.-Ing. Ulrich Römer  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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**Exams**

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

**Competence Certificate**

Written examination, 180 min.

**Prerequisites**

none

**Recommendation**

Engineering Mechanics III/IV

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

**Introduction to Multibody Dynamics**

2162235, SS 2024, 3 SWS, Language: German, [Open in study portal](#)

**Content**

The role of multibody systems in engineering, kinematics of a single rigid body, Kinematics of multibody systems, rotation matrix, angular velocity, derivatives in different reference systems, holonomic and non-holonomic constraints, Newton-Euler's equations, principle of d'Alembert, principle of virtual power, Lagrange's equations, Kane's equations, structure of the equations of motion

**Literature**

Wittenburg, J.: Dynamics of Systems of Rigid Bodies, Teubner Verlag, 1977  
Kane, T.: Dynamics of rigid bodies.
Course: Introduction to nanotechnology [T-MACH-111814]

**Responsible:** apl. Prof. Dr. Hendrik Hölscher

**Organisation:**
KIT Department of Mechanical Engineering
KIT Department of Economics and Management

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

<table>
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<td>Each summer term</td>
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**Events**

| ST 2024 | 2142152 | Introduction to Nanotechnology | 2 SWS | Lecture / Hölscher |

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

**Competence Certificate**
written exam 90 min

**Prerequisites**
none

**Annotation**
Brick T-MACH-111814 may not be started

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

**Content**
Nanotechnology deals with the fabrication and analysis of nanostructures. The topics of the lecture include:

- the most common measurement principles of nanotechnology especially scanning probe methods
- the analysis of physical and chemical properties of surfaces
- interatomic forces and their influence on nanostructures
- methods of micro- and nanofabrication and lithography
- basic models of contact mechanics and nanotribology
- important functional characteristics of nanodevices

Basic knowledge in mathematics and physics is assumed.
The successfull attendance of the lecture is controlled by a 30 minutes oral exam.

**Organizational issues**
Es werden im ILIAS Materialien (Videos, Originalliteratur, Übungen) zum Vertiefung zur Verfügung gestellt.
Für die mündlichen Prüfungen werden zwei Termine angeboten (erste Woche nach Vorlesungsende im Sommersemester und eine Woche vor Vorlesungsbeginn im Wintersemester).

**Literature**
Alle Folien und Originalliteratur werden auf ILIAS zur Verfügung gestellt.
3.194 Course: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

**Responsible:** apl. Prof. Dr. Ron Dagan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Each summer term</td>
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**Events**

| ST 2024 | 2190490 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | 2 SWS | Lecture / 📚 | Dagan |

**Exams**

| WT 23/24 | 76-T-MACH-105466 | Introduction to Neutron Cross Section Theory and Nuclear Data Generation | Dagan |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📚 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam of about 30 minutes

**Prerequisites**
none

**Annotation**
none

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

**Introduction to Neutron Cross Section Theory and Nuclear Data Generation**

2190490, SS 2024, 2 SWS, Language: German/English, [Open in study portal](#)

**Lecture (V)**

**On-Site**

**Content**

Cross section characterization
Summary of basic cross section theory
Resonance cross section
Doppler broadening
Scattering kernels
Basic of slowing down theory
Unit cell based XS data generation
Cross sections Data libraries
Data Measurements

The students:

- Understand the special importance of cross sections in various domains of natural science (Reactor physics, Material research, Solar radiation etc.)
- Are familiar with the theoretical methods and experimental effort to generate cross sections data.

Regular attendance: 26 h  
self study: 94 h  
oral exam about 30 min.

**Literature**

Handbuch von Nuklearen Reaktoren Vol I . Y. Ronen CRC press 1986 (in English)  
P. Tippler, R. Llewellyn Modern Physics 2008 (in English)
3.195 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

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

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

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<th>Events</th>
<th>Credits</th>
<th>Content</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Introduction to Nonlinear Vibrations</td>
</tr>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Introduction into the nonlinear vibrations (Tutorial)</td>
</tr>
</tbody>
</table>

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

**Prerequisites**  
none

**Recommendation**  
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

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

**Introduction to Nonlinear Vibrations**  
2162247, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

- dynamic systems
- basic ideas of asymptotic methods
- perturbation methods: Linstedt-Poincare, averaging, multiple scales
- limit cycles
- nonlinear resonance
- basics of the bifurcation analysis, bifurcation diagrams
- types of bifurcations
- discontinuous systems
- dynamic chaos

**Literature**

<table>
<thead>
<tr>
<th>Content</th>
<th>Exercises related to the lecture</th>
<th>Practice (Ü) On-Site</th>
</tr>
</thead>
</table>

Introduction into the nonlinear vibrations (Tutorial)
2162248, WS 23/24, 2 SWS, Language: German, Open in study portal
3.196 Course: Introduction to Nuclear Energy [T-MACH-105525]

**Responsible:** Prof. Dr.-Ing. Xu Cheng  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>2 SWS</td>
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**Exams**

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<td>Cheng</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗼 On-Site, ✗ Cancelled

**Competence Certificate**  
oral exam, 30 min

**Prerequisites**  
none

**Content**  
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the fundamental knowledge of nuclear energy and nuclear reactors. After the lecture the students understand the principle of the usage of nuclear energy, the structure and operation of nuclear power plants and nuclear safety measures. Furthermore, the students are capable of giving technical assessment of the usage of nuclear energy with respect to its safety and sustainability.
### 3.197 Course: Introduction to Operations Research I and II [T-WIWI-102758]

**Responsible:** Prof. Dr. Stefan Nickel  
Prof. Dr. Steffen Rebennack  
Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management  
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

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<td>2530043</td>
<td>Introduction to Operations Research II</td>
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**Exams**

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<td>Introduction to Operations Research I and II</td>
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</table>

**Lecture (V)**

**Blended (On-Site/Online)**

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**Competence Certificate**

The assessment of the module is carried out by a written examination (120 minutes) according to Section 4(2), 1 of the examination regulation. In each term (usually in March and August), one examination is held for both courses. The overall grade of the module is the grade of the written examination.

**Prerequisites**

None

**Recommendation**

Knowledge of Mathematics I and II is recommended, as well as programming knowledge for the software laboratory. It is strongly recommended to attend the course Introduction to Operations Research I [2550040] before attending the course Introduction to Operations Research II [2530043].

---

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

**Introduction to Operations Researcch II**

2530043, WS 23/24, 2 SWS, Open in study portal

**Lecture (V)**

**Blended (On-Site/Online)**
Content
Integer and combinatorial optimization: basic concepts, cutting plane methods, branch-and-bound methods, branch-and-cut methods, heuristic methods.

Nonlinear optimization: basic concepts, optimality conditions, solution methods for convex and nonconvex optimization problems.

Dynamic and stochastic models and methods: Dynamic optimization, Bellman methods, lot-sizing models and dynamic and stochastic models of inventory, queues.

Learning Objectives:
The student

• knows and describes the basic concepts of integer and combinatorial optimization, nonlinear optimization and dynamic optimization,
• knows the methods and models indispensable for a quantitative analysis,
• models and classifies optimization problems and selects appropriate solution procedures to solve simple optimization problems independently,
• validates, illustrates and interprets obtained solutions.

Literature
• Murty: Operations Research. Prentice-Hall, 1995

Introduction to Operations Research I
2550040, SS 2024, 2 SWS, Language: German, Open in study portal

Content
Examples for typical OR problems.

Linear Programming: Basic notions, simplex method, duality, special versions of the simplex method (dual simplex method, three phase method), sensitivity analysis, parametric optimization, game theory.

Graphs and Networks: Basic notions of graph theory, shortest paths in networks, project scheduling, maximal and minimal cost flows in networks.

Learning objectives:
The student

• names and describes basic notions of linear programming as well as graphs and networks,
• knows the indispensable methods and models for quantitative analysis,
• models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
• validates, illustrates and interprets the obtained solutions.

Literature
• Murty: Operations Research. Prentice-Hall, 1995
3.198 Course: Introduction to the Finite Element Method [T-MACH-105320]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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<th>Lecture /</th>
<th>Langhoff, Böhlke</th>
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</table>

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

**Competence Certificate**

written exam (90 min)

prerequisites: passing the corresponding "Tutorial to Introduction to the Finite element method" (T-MACH-110330)

**Prerequisites**

Passing the "Tutorial to Introduction to the Finite element method" (T-MACH-110330) is a prerequisite for taking part in the exam.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-110330 - Tutorial Introduction to the Finite Element Method must have been passed.

**Annotation**

Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials are expected

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

**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
3.199 Course: Introduction to Theory of Materials [T-MACH-105321]

**Responsible:** apl. Prof. Marc Kamlah

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

| ST 2024 | 2182732 | Introduction to Theory of Materials | 2 SWS | Lecture / 🗣️ | Kamlah |

**Exams**

| WT 23/24 | 76-T-MACH-105321 | Introduction to Theory of Materials | Kamlah |

**Competence Certificate**

oral exam

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

**Introduction to Theory of Materials**

2182732, SS 2024, 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**

[2] Skript
3.200 Course: IoT Platform for Engineering [T-MACH-106743]

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

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

<table>
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<td>Project (P / 🗣️)</td>
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<th></th>
<th></th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

Competence Certificate
Assessment of another type (graded), Group teaching project on Industry 4.0 consisting of: Conception, implementation, accompanying documentation and final presentation.

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

**V** IoT platform for engineering 2123352, WS 23/24, 3 SWS, Language: German, Open in study portal

Project (PRO) On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can
- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature
Keine / None

**V** IoT platform for engineering 2123352, SS 2024, 3 SWS, Language: German, Open in study portal

Project (PRO) On-Site

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can
- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature
Keine / None
Lab Computer-Aided Methods for Measurement and Control

**Course Information**

**Responsible:** Marvin Klemp
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Completed coursework
**Credits:** 4
**Grading scale:** pass/fail
**Recurrence:** Each winter term
**Version:** 1

**Events**

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<td>3 SWS</td>
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<td>Stiller, Immel</td>
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**Exams**

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

**Competence Certificate**

Colloquia

**Prerequisites**

none

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

Lab Computer-aided methods for measurement and control

**Content**

Lerninhalt (EN):

1. Digital technology
2. Digital storage oscilloscope and digital spectrum analyzer
3. Supersonic computer tomography
4. Lighting and image acquisition
5. Digital image processing
6. Image interpretation
7. Control synthesis and simulation
8. Robot: Sensors
9. Robot: Actuating elements and path planning

The lab comprises 9 experiments.

Voraussetzungen: Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand (EN): 120 hours

Lernziele (EN):

Powerful and cheap computation resources have led to major changes in the domain of measurement and control. Engineers in various fields are nowadays confronted with the application of computer-aided methods. This lab tries to give an insight into the modern domain of measurement and control by means of practically oriented and flexible experiments. Based on experiments on measurement instrumentation and digital signal processing, elementary knowledge in the domain of visual inspection and image processing will be taught. Thereby, commonly used software like MATLAB/Simulink will be used in both simulation and realization of control loops. The lab closes with selected applications, like control of a robot or supersonic computer tomography.

Nachweis (EN):

Colloquia
Literature
Übungsanleitungen sind auf der Institutshomepage erhältlich.
Instructions to the experiments are available on the institute's website
### 3.202 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Prof. Dr. Ulrich Maas  
Dr.-Ing. Heinrich Wirbser

**Organisation:** KIT Department of Mechanical Engineering  
Institute of Thermal Turbomachinery

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

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<td>Laboratory Exercise in Energy Technology</td>
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<td>Practical course</td>
<td>Bauer, Maas, Bykov</td>
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<td>2171487</td>
<td>Laboratory Exercise in Energy Technology</td>
<td>3</td>
<td>Practical course</td>
<td>Bauer, Maas, Bykov, Schießl</td>
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#### Exams

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

**Competence Certificate**

1 report, approx. 12 pages  
Discussion of the documented results with the assistants

**Prerequisites**

none

---

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

#### Laboratory Exercise in Energy Technology

2171487, WS 23/24, 3 SWS, Language: German/English, Open in study portal

Practical course (P)  
On-Site
Content
Online registration within the first two weeks of the lecture period at: http://www.its.kit.edu

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
  - Exhaust gas turbocharger
  - Cooling Tower
  - Heat pump
  - Plant oil stove
  - Heat capacity
  - Wood combustion

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used
Content
Online registration within the first two weeks of the lecture period at: http://www.its.kit.edu

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger
- Cooling Tower
- Heat pump
- Plant oil stove
- Heat capacity
- Wood combustion

Regular attendance: 42h
Self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages
Discussion of the documented results with the assistants

Duration: 30 minutes

No tools or reference materials may be used

Organizational issues
Information zum Lehrlabor finden Sie auf der Instituts-homepage
### 3.203 Course: Laboratory Laser Materials Processing [T-MACH-102154]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Laboratory &quot;Laser Materials Processing&quot;</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

#### Competence Certificate

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

#### Prerequisites

None

#### Recommendation

Basic knowledge of physics, chemistry and material science is assumed.

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

<table>
<thead>
<tr>
<th>Title Description</th>
<th>Practical course (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory &quot;Laser Materials Processing&quot;</td>
<td>Blended (On-Site/Online)</td>
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</table>
Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

- safety aspects
- surface hardening and remelting
- melt and reactive cutting
- surface modification by dispersing or alloying
- welding
- surface texturing
- metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Organizational issues
Maximal 12 Teilnehmer/innen!
Aktuell sind alle Plätze vergeben! Registrierung für die Nachrückliste möglich per Email an johannes.schneider@kit.edu
Praktikum findet in Kleingruppen semesterbegleitend (dienstags bzw. mittwochs, halbtägig) auf dem Campus Nord am IAM-AWP (Geb. 681) und auf dem Campus Süd am IAM-CMS (Geb. 30.48) statt!

Termine werden mit den Teilnehmern/innen direkt abgestimmt.

Literature
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

- safety aspects
- surface hardening and remelting
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There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student
- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
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Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Organizational issues
Die Praktikumsplätze für das Sommersemester 2024 sind bereits ausgebucht!

Anmeldung per Email an johannes.schneider@kit.edu

Das Praktikum findet semesterbegleitend in Kleingruppen am IAM-ZM (CS) bzw. IAM-AWP (CN) statt!

Die Termine werden zu Beginn des Semesters bekannt gegeben.

Literature
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
Course: Laboratory Mechatronics [T-MACH-105370]

**Responsible:**
- Prof. Dr. Veit Hagenmeyer
- Prof. Dr.-Ing. Christoph Stiller

**Organisation:**
KIT Department of Mechanical Engineering

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

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**Exams**

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<td>3 SWS</td>
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**Competence Certificate**
The laboratory course is offered exclusively as ungraded course work. The assessment consists of a group colloquium at the beginning of the individual specialization phases (Part 1). In addition, a robot control system for a pick-and-place task must be successfully implemented in the group phase (Part 2).

**Prerequisites**
None

**Content**

**Part I**
- Control, programming and simulation of robots
- CAN-Bus communication
- Image processing / machine vision
- Dynamic simulation of robots in ADAMS

**Part II**
Solution of a complex problem in team work

**Learning objectives:**
The student is able to ...

- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

**Nachweis (EN):** certificate of successful attendance

**Voraussetzung (EN):** none

**Arbeitsaufwand (EN):**
- regular attendance: 33.5 h
- self-study: 88.5 h
Organizational issues
Das Praktikum ist anmeldepflichtig.
Die Anmeldungsmodalitäten-/fristen werden auf https://www.iai.kit.edu/Pruefungen.php bekannt gegeben.
Siehe Internet / Aushang Raum 033 EG, im Gebäude 40.32.

Literature
Materialien zum Mechatronik-Praktikum
Manuals for the laboratory course on Mechatronics
3.205 Course: Laboratory Solar Energy [T-ETIT-104686]

**Responsible:** Dr.-Ing. Klaus Trampert  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Exams**

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</table>

**Prerequisites**

none
3.206 Course: Laser in Automotive Engineering [T-MACH-105164]

**Responsible:** Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 3

### Events

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<td>Laser Material Processing</td>
<td>2 SWS</td>
<td>Lecture / 🗣️</td>
<td>Schneider</td>
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### Exams

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<td>76-T-MACH-105164</td>
<td>Laser in Automotive Engineering</td>
<td>Schneider</td>
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<tr>
<td>ST 2024</td>
<td>76-T-MACH-105164</td>
<td>Laser in Automotive Engineering / Laser Material Processing</td>
<td>Schneider</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**

oral examination (30 min)

no tools or reference materials

**Prerequisites**

It is not possible, to combine this brick with brick Laser Material Processing [T-MACH-112763], brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102]

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
2. The course T-MACH-112763 - Laser Material Processing must not have been started.

**Recommendation**

preliminary knowledge in mathematics, physics and materials science

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

**V Laser Material Processing**

2182642, SS 2024, 2 SWS, Language: English, Open in study portal
Content
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in material processing
- 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-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.
It is not possible, to combine this lecture with the lecture Physical basics of laser technology [2181612].

regular attendance: 22.5 hours
self-study: 97.5 hours
oral examination (ca. 30 min)

no tools or reference materials

Organizational issues
Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!
The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature
P. Poprawe: Tailored Light 1, 2018, Springer
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
3 COURSES

3.207 Course: Laser Material Processing [T-MACH-112763]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
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Events

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<th>SWS</th>
<th>Type</th>
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<tbody>
<tr>
<td>ST 2024</td>
<td>2182642</td>
<td>Laser Material Processing</td>
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Exams

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<th>Title</th>
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<td>Laser Material Processing</td>
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<td>ST 2024</td>
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<td>Laser Material Processing</td>
<td>Schneider</td>
</tr>
</tbody>
</table>

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

Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with Laser in Automotive Engineering [T-MACH-105164], brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102].

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.
2. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.

Recommendation
preliminary knowlegde in mathematics, physics and materials science

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

V Laser Material Processing
2182642, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V) On-Site
Content
Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in material processing
- 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-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.
It is not possible, to combine this lecture with the lecture Physical basics of laser technology [2181612].

regular attendance: 22,5 hours
self-study: 97,5 hours
oral examination (ca. 30 min)

no tools or reference materials

Organizational issues
Die Vorlesung ersetzt die bisherige Vorlesung "Lasereinsatz im Automobilbau" und wird jetzt auf Englisch angeboten!
The lecture replaces the previous lecture "Laser Application in Automotive Engineering" and is now offered in English!

Literature
P. Poprawe: Tailored Light 1, 2018, Springer
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
### Course: Leadership and Conflict Management [T-MACH-105440]

**Responsible:** Hans Hatzl  
**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 2

---

#### Competence Certificate

oral exam (approx. 30 min)

#### Prerequisites

It is not possible to combine this brick with brick Leadership and Conflict Management [T-MACH-111070].

#### Annotation

This lecture will also be offered once in winter term 20/21.

---

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

#### Leadership and Conflict Management (in German)

2110017, SS 2024, 2 SWS, Language: German, Open in study portal

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

---

### Content

In this compact event, management and leadership techniques are taught which are among the key qualifications for management tasks. Furthermore, you will be prepared for management and leadership tasks.

The course consists of the following course contents:

1. Introduction to the topic  
   - Goal setting and goal achievement  
   - Management techniques in planning  
   - Communication and information  
   - Decision Theory  
   - Leadership and cooperation  
   - Self Management  
   - Conflict management and strategy  
   - Case studies

It passes:

- Obligatory attendance

**recommendations:**

- Knowledge of work and economic science is advantageous

### Literature

Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.
3.209 Course: Leadership and Management Development [T-MACH-105231]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen  
Andreas Ploch

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

<table>
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<tr>
<th>WT 23/24</th>
<th>2145184</th>
<th>Leadership and Product Development</th>
<th>2 SWS</th>
<th>Lecture / 🗣️</th>
<th>Ploch</th>
</tr>
</thead>
</table>

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

**Prerequisites**
It is not possible to combine this brick with brick Leadership and Management Development [T-MACH-112585].

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

**Leadership and Product Development**

2145184, WS 23/24, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**On-Site**

**Content**
Overview of leadership theories and their application
Selected management instruments and their use in organizations
Communication and leadership
change management
Management development and MD programmes
Assessment centres and management audits
Teamwork, team development and team roles
Coaching as an instrument of modern leadership
Intercultural competence and cross-cultural leadership
Management and ethics, corporate governance
Practical exercises and examples to deepen selected contents

**Organizational issues**
Vorlesungsanmeldung und Informationen zur Veranstaltung werden im ILIAS Kurs zur Verfügung gestellt.
Weitere Information siehe IPEK-Homepage

**Literature**
Vorlesungsumdruck
3.210 Course: Liberalised Power Markets [T-WIWI-107043]

Responsible: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

<table>
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Events

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Exams

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

Competence Certificate

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Recommendation

None

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

Liberalised Power Markets

2581998, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture (V)

On-Site
Content

1. Power markets in the past, now and in future
2. Designing liberalised power markets
   2.1. Unbundling Dimensions of liberalised power markets
   2.2. Central dispatch versus markets without central dispatch
   2.3. The short-term market model
   2.4. The long-term market model
   2.5. Market flaws and market failure
   2.6. Regulation in liberalised markets
3. The power (sub)markets
   3.1 Day-ahead market
   3.2 Intraday market
   3.3 (Long-term) Forwards and futures markets
   3.4 Emission rights market
   3.5 Market for ancillary services
   3.6 The “market” for renewable energies
   3.7 Future market segments
4. Grid operation and congestion management
   4.1. Grid operation
   4.2. Congestion management
5. Market power
   5.1. Defining market power
   5.2. Indicators of market power
   5.3. Reducing market power
6. Future market structures in the electricity value chain
   1. Power markets in the past, now and in future
   2. Designing liberalised power markets
      2.2. Unbundling Dimensions of liberalised power markets
      2.3. Central dispatch versus markets without central dispatch
      2.4. The short-term market model
      2.5. The long-term market model
      2.6. Market flaws and market failure
      2.7. Regulation in liberalised markets
   3. The power (sub)markets
      3.1 Day-ahead market
      3.2 Intraday market
      3.3 (Long-term) Forwards and futures markets
      3.4 Emission rights market
      3.5 Market for ancillary services
      3.6 The “market” for renewable energies
      3.7 Future market segments
   4. Grid operation and congestion management
      4.1. Grid operation
      4.2. Congestion management
   5. Market power
      5.1. Defining market power
      5.2. Indicators of market power
      5.3. Reducing market power
   6. Future market structures in the electricity value chain

Literature
Weiterführende Literatur:
3.211 Course: Lighting Engineering [T-ETIT-100772]

**Responsible:** Prof. Dr. Cornelius Neumann  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Events**

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<td>2313741</td>
<td>Lighting Engineering (Tutorial to 2313739)</td>
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**Exams**

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<td>WT 23/24</td>
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<td>Neumann</td>
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**Legend:** 🖥 Online, 📚 Blended (On-Site/Online), 🗣 On-Site, ☓ Cancelled

**Prerequisites**

none
3.212 Course: Lightweight Engineering Design [T-MACH-105221]

Responsibilities: Prof. Dr.-Ing. Tobias Düser
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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<td>2 SWS</td>
<td>Albers, Burkardt</td>
<td>Each summer term</td>
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<td>Each summer term</td>
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</tbody>
</table>

Competence Certificate
Written examination (90 min)

Prerequisites
None

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

Content
General aspects of lightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling
Additionally, guest speakers from industry will present lightweight design from an practical point of view.

The students are able to ...

• evaluate the potential of central lightweight strategies and their application in design processes.
• apply different stiffing methods qualitatively and to evaluate their effectiveness.
• evaluate the potential of computer-aided engineering as well as the related limits and influences on manufacturing.
• reflect the basics of lightweight construction from a system view in the context of the product engineering process.
Organizational issues
Vorlesungsfolien können über die eLearning-Plattform ILIAS bezogen werden.
Die Prüfungsart wird gemäß der Prüfungsordnung zu Vorlesungsbeginn angekündigt:

- Schriftliche Prüfung: 90 min Prüfungsdauer
- Mündliche Prüfung: 20 min Prüfungsdauer
- Erlaubte Hilfsmittel: keine

Medien: Beamer

Arbeitsbelastung:

- Präsenzzeit: 21 h
- Selbststudium: 99 h

Lecture slides are available via eLearning-Platform ILIAS.
The type of examination (written or oral) will be announced at the beginning of the lecture:

- written examination: 90 min duration
- oral examination: 20 min duration
- auxiliary means: None

Media: Beamer

Workload:

- regular attendance: 21 h
- self-study: 99 h

Literature
Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007
### 3.213 Course: Liquid Transportation Fuels [T-CIWVT-111095]

**Responsible:** Prof. Dr. Reinhard Rauch  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

<table>
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**Legend:** 🏥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Learning Control is an oral examination with a duration of about 20 minutes.

**Prerequisites**

None
# 3.214 Course: Localization of Mobile Agents [T-INFO-101377]

**Responsible:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

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## Exams

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3.215 Course: Logistics and Supply Chain Management [T-WIWI-102870]

**Responsible:** Prof. Dr. Frank Schultmann

**Organisation:** KIT Department of Economics and Management

**Part of:** M-MACH-104884 - Courses of the KIT Department of Economics and Management

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<td>2 SWS</td>
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**Exams**

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<td>Lecture</td>
<td>Schultmann</td>
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**Competence Certificate**

The assessment consists of an oral (30 minutes) or written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

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

**V Logistics and Supply Chain Management**

2581996, SS 2024, 2 SWS, Language: English, Open in study portal

**Lecture (V)**

**On-Site**

**Content**

Students are introduced to the methods and tools of logistics and supply chain management. They learn the key terms and components of supply chains together with key economic trade-offs. In detail, students gain knowledge of decisions in supply chain management, such as facility location, supply chain planning, inventory management, pricing and supply chain cooperation. In this manner, students will gain knowledge in analyzing, designing and steering of decisions in the domain of logistics and supply chain management.

- Introduction: Basic terms and concepts
- Facility location and network optimization
- Supply chain planning I: flexibility
- Supply chain planning II: forecasting
- Inventory management & pricing
- Supply chain coordination I: the Bullwhip-effect
- Supply chain coordination II: double marginalization
- Supply chain risk management

**Literature**

Wird in der Veranstaltung bekannt gegeben.
### 3.216 Course: Logistics and Supply Chain Management [T-MACH-110771]

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

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

<table>
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<td>English</td>
<td>Lecture / 🗣️</td>
<td>Furmans, Alicke</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ☑️ Cancelled

**Competence Certificate**

The success control takes place in the form of an examination performance of a different kind. This is composed as follows:

- 50% assessment of a written examination (60 min) during the semester break
- 50% assessment of an oral examination (20 min) during the semester break

To pass the examination, both examination performances must be passed.

**Prerequisites**

None

**Annotation**

The brick cannot be taken if one of the bricks "T-MACH-102089 – Logistics - Organisation, Design and Control of Logistic Systems" and "T-MACH-105181 – Supply Chain Management" has been taken.

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

#### Logistics and Supply Chain Management

<table>
<thead>
<tr>
<th>Credits</th>
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<th>WS</th>
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<td>English</td>
<td>Lecture / 🗣️</td>
<td>Furmans, Alicke</td>
</tr>
</tbody>
</table>

**Content**

In the lecture "Logistics and Supply Chain Management", comprehensive and well-founded fundamentals of crucial issues in logistics and supply chain management are presented. Furthermore, the interaction of different design elements of supply chains is emphasized. For this purpose, both qualitative and quantitative models are presented and applied. Additionally, methods for mapping and evaluating logistics systems and supply chains are described. The contents of the lecture are deepened in exercises and case studies and comprehension is partially reviewed in case studies. The contents will be illustrated, among other things, on the basis of supply chains in the automotive industry.

Among others, the following topics are covered:

- Inventory Management
- Forecasting
- Bullwhip Effect
- Supply Chain Segmentation and Collaboration
- Key Performance Indicators
- Supply Chain Risk Management
- Production Logistics
- Location Planning
- Route Planning

It is intended to provide an interactive format in which students can also contribute (and work alone or in groups). Since logistics and supply chain management (also in times during and after Corona) requires working in an international environment and therefore many terms are derived from English, the lecture will be held in English.
Course: Machine Dynamics [T-MACH-105210]

3.217 Course: Machine Dynamics [T-MACH-105210]

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

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

**Type**  
Written examination

**Credits**  
5

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

Events

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Exams

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

Competence Certificate  
written exam, 180 min.

Prerequisites  
none

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

**Machine Dynamics**  
2161224, WS 23/24, 2 SWS, Language: English, Open in study portal

Lecture (V)  
Online

Content

1. Introduction
2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing

Literature

Biezeno, Grammel: Technische Dynamik, 2. Aufl., 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

**Machine Dynamics**  
2161224, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V)  
On-Site

Content

1. Introduction
2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing
Literature
Biezeno, Grammel: Technische Dynamik, 2. Aufl., 1953
Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979
Dresig, Vulfson: Dynamik der Mechanismen, 1989

Machine Dynamics (Tutorial)
2161225, SS 2024, 1 SWS, Language: English, Open in study portal

Content
Exercises related to the lecture
3.218 Course: Machine Dynamics II [T-MACH-105224]

**Responsible:** Prof. Dr.-Ing. Carsten Proppe

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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<td>2 SWS</td>
<td>Lecture / 📖</td>
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**Exams**

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<td>Lecture / 📖</td>
</tr>
<tr>
<td>ST 2024</td>
<td>2 SWS</td>
<td>Lecture / 📖</td>
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</table>

**Competence Certificate**
oral exam, 30 min.

**Prerequisites**
none

**Recommendation**
Machine Dynamics

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

**Machine Dynamics II**
2162220, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)

**Content**
hydrodynamic bearings
- rotating shafts in hydrodynamic bearings
- belt drives
- vibration of turbine blades

**Organizational issues**
Die Vorlesung wird ausschließlich online angeboten.

**Literature**

**Machine Dynamics II**
2162220, SS 2024, 2 SWS, Language: German/English, [Open in study portal](#)

**Content**
Students are able to develop and analyze detailed models in machine dynamics that encompass continuum models, fluid structure interaction, and stability analyses.
- hydrodynamic bearings
  - rotating shafts in hydrodynamic bearings
  - belt drives
  - vibration of turbine blades

**Literature**
3.219 Course: Machine Tools and High-Precision Manufacturing Systems [T-MACH-110962]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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**Exams**

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**Competence Certificate**

Oral exam (40 minutes)

**Prerequisites**

T-MACH-102158 - Machine Tools and Industrial Handling must not be commenced.  
T-MACH-109055 - Machine Tools and Industrial Handling must not be commenced.  
T-MACH-110963 - Machine Tools and High-Precision Manufacturing Systems must not be commenced.

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

**Machine Tools and High-Precision Manufacturing Systems**

2149910, WS 23/24, 6 SWS, Language: German, Open in study portal
Content
The lecture gives an overview of the construction, use and application of machine tools and high-precision manufacturing systems. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools and high-precision manufacturing systems is conveyed. First, the main components of the systems are systematically explained and their design principles as well as the integral system design are discussed. Subsequently, the use and application of machine tools and high-precision manufacturing systems will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0 and artificial intelligence.
Guest lectures from industry round off the lecture with insights into practice.

The individual topics are:

- Structural components of dynamic manufacturing Systems
- Feed axes: High-precision positioning
- Spindles of cutting machine Tools
- Peripheral Equipment
- Machine control unit
- Metrological Evaluation
- Maintenance strategies and condition Monitoring
- Process Monitoring
- Development process for machine tools and high-precision manufacturing Systems
- Machine examples

Learning Outcomes:
The students …

- are able to assess the use and application of machine tools and high-precision manufacturing systems and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of machine tools and high-precision manufacturing systems (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of machine tools and high-precision manufacturing systems.
- are capable of selecting and evaluating machine tools and high-precision manufacturing systems according to technical and economic criteria.

Workload:
MACH:
regular attendance: 63 hours
self-study: 177 hours
WING/TVWL:
regular attendance: 63 hours
self-study: 207 hours

Organizational issues
Vorlesungstermine montags und mittwochs, Übungstermine donnerstags.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

Lectures on Mondays and Wednesdays, tutorial on Thursdays.
The tutorial dates will be announced in the first lecture.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiseinheiten im Umfeld der Karlsruher Forschungsfabrik unterstüzt.
The theoretical lectures are complemented by practical lectures in the Karlsruhe Research Factory to deepen the acquired knowledge.

Literature
Medien:
Skript zur Veranstaltung wird über Ilias bereitgestellt.

Media:
Lecture notes will be provided in Ilias.
3.220 Course: Machine Vision [T-MACH-105223]

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

Organisation: KIT Department of Mechanical Engineering

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

<table>
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<td>Machine Vision</td>
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Exams

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Competence Certificate

Type of Examination: written exam
Duration of Examination: 60 minutes

Prerequisites

None

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

Machine Vision

2137308, WS 23/24, 4 SWS, Language: English, Open in study portal

Content

Lernziele (EN):

*Machine vision (or computer vision)* describes all kind of techniques that can be used to extract information from camera images in an automated way. Considerable improvements of machine vision techniques throughout recent years, e.g. by the advent of deep learning, have caused growing interest in these techniques and enabled applications in various domains, e.g. robotics, autonomous driving, gaming, production control, visual inspection, medicine, surveillance systems, and augmented reality.

The participants should gain an overview over the basic techniques in machine vision and obtain hands-on experience.

Nachweis: written exam, 60 min.
Arbeitsaufwand: 240 hours
Voraussetzungen: none

Literature

Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.
3.221 Course: Machines and Processes [T-MACH-105208]

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

**Organisation:** KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

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

**Type:** Written examination  
**Credits:** 7  
**Grading scale:** Grade to a third  
**Recurrence:** Each term  
**Version:** 2

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

**Competence Certificate**  
written exam (duration: 120 min)

**Prerequisites**  
Taking part at the exam is possible only when lab course has been successfully completed

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

1. The course T-MACH-105232 - Machines and Processes, Prerequisite must have been passed.

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

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<td>Lecture / Practice (VÜ) On-Site</td>
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</table>

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)  
Module Handbook as of 23/02/2024
Content

- Introduction to power engineering
- Radial and axial turbines
- Pumps
- Compressors
- Blowers
- Wind turbines
- Fuel cells
- Energy storage
- E-motors
- Heat pumps
- Combined heat and power
- Diesel engines
- Gasoline engines
- Hydrogen engines
3.222 Course: Machines and Processes, Prerequisite [T-MACH-105232]

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

**Organisation:** KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

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

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**Exams**

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</table>

**Competence Certificate**

successful completed training course

**Prerequisites**

none

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

**Machines and Processes**

2187000, WS 23/24, 1 SWS, [Open in study portal](#)

Content

Lab Course Experiment

**Machines and Processes (Lab Course)**

2187000, SS 2024, 1 SWS, Language: German, [Open in study portal](#)
3 COURSES

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

Content
successful lab course and written exam (2 h)
Taking part at the exam is possible only when lab course has been successfully completed
Lab course and lecture take place in summer and winter semester.
In the SS the lecture is held in English. The lab course is always bilingual.

Media:
slides to download
Documentation of the labcourse
basics of thermodynamics
thermal fluid machines
  • steam turbines
  • gas turbines
  • combined-cycle plants
  • turbines and compressors
  • aircraft engines
hydraulic fluid machines
  • operating performance
  • characterization
  • control
  • cavitation
  • wind turbines, propellers
internal combustion engines
  • characteristic parameters
  • engine parts
  • kinematics
  • engine processes
  • emissions
regular attendance: 48 h, self-study: 160 h
The students can name and describe basic energy conversion processes and energy converting machines. They can explain the application of these energy conversion processes in various machines. They can analyze and evaluate the processes and machines in terms of functionality and efficiency and they are able to solve basic technical problems in terms of operating the machines.
3.223 Course: Magnet Technology of Fusion Reactors [T-MACH-105434]

**Responsible:** Dr. Walter Fietz  
Dr. Klaus-Peter Weiss

**Organisation:** KIT Department of Mechanical Engineering

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

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<th>Lecture / 🗣</th>
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**Legend:** 🖥 Online, 🏞 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**Competence Certificate**

Oral examination of about 30 minutes

**Prerequisites**

none

**Annotation**

none

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

**Magnet Technology of Fusion Reactors**

2190496, SS 2024, 2 SWS, Language: German/English, [Open in study portal]

Lecture (V)

On-Site
Content

In Greifswald/Germany the fusion experiment Wendelstein 7-X is now in operation to demonstrate the performance of Stellerator-type fusion machines. In south of France the fusion reactor ITER is under construction which will demonstrate the production of energy by fusion. In both machines the plasma inclusion will be ensured by magnets and to produce high magnetic fields in an efficient way, these magnets have to be superconducting. Design, construction and operation of such magnets is a technologic challenge because low temperature (4.5 K) and high currents (typ. 68 kA) are necessary.

The lecture will show basic principles for design and construction of such magnets and includes:

- Introduction with examples to nuclear fusion and to magnetic plasma confinement
- Basics of low temperature and high temperature properties and cryotechnique
- Material testing and critical material properties at low temperatures
- Principles of magnet design, construction and safe magnet operation
- Present status and magnet examples from fusion projects ITER, W7-X and JT-60SA
- Application of high temperature superconductors on fusion and power engineering

The goal of the lecture is to impart the fundamentals of construction of superconducting magnets. Magnet technology is inherently of multidisciplinary character e.g. material properties at low temperature, high voltage and high current technique. The use of superconductors is mandatory to reach highest magnetic fields with comparable small losses. Examples of magnets from power application, basic research and fusion reactor construction are discussed.

Lecture Content:

- Basics of nuclear fusion and design aspects of fusion magnets
- Superconductors - basics and stability
- Low temperature cryogenic aspects
- Low temperature and high temperature superconductors
- Cryogenic material testing and properties of fusion materials at low temperatures
- Quench and high voltage aspects for magnets
- Status and magnets of fusion machines ITER, W7-X, JT-60SA & future DEMO
- Impact of high temperature superconductors on fusion and power engineering

Educational objective: The students know:

- Magnetic plasma confinement principles in connection with fusion machine
- Examples and basic properties of different superconductors
- Basics of formation of superconducting cables and magnet construction
- Generation of low temperature, cryostat construction
- Basics of magnet design and magnet safety
- Material testing and material properties at low temperatures
- High-temperature superconductor use in magnet construction and power application

Recommendations:

Knowledge in energy technology, power plants, material testing is welcomed

- Time of attendance: 2 SWS, Other: excursion, etc. 5 hours
- Self-study: preparation and postprocessing LV (course): 1 hour / week
- Preparation for the examination: 80 hours per semester

Oral examination of about 30 minutes
**Course: Magnetohydrodynamics [T-MACH-105426]**

**Responsible:** apl. Prof. Dr. Leo Bühler  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Type**  
Oral examination  
**Credits**  
4  
**Grading scale**  
Grade to a third  
**Recurrence**  
Each winter term  
**Version**  
1

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**Competence Certificate**  
oral  
Duration: 30 minutes  
No auxiliary means

**Prerequisites**  
The partial performance number T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) must not be started or completed.  
The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

**Recommendation**  
Fluid Mechanics (T-MACH-105207)  
Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

**Magnetohydrodynamics**  
2153429, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

- Introduction  
- Basics of electro and fluid dynamics  
- Exact solutions, Hartmann flow, pump, generator, channel flows  
- Inductionless approximation  
- Developing flows, change of cross-section, variable magnetic fields  
- Alfvén waves  
- Stability, transition to turbulence  
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

**Literature**

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher  
3.225 Course: Management Accounting 1 [T-WIWI-102800]

Responsible: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

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Exams

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

Competence Certificate
The assessment consists of a written exam (120 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Recommendation
We recommend that you take part in our exercise for the lecture.

Annotation
The exercise is offered separately for Bachelor's students as well as for students in the Master's transfer and Master's program.

Note for exam registration:

- Bachelor students: 79-2579900-B Management Accounting 1 (Bachelor)
- Students in the Master's transfer and Master's program: 79-2579900-M Management Accounting 1 (Master's transfer and Master)

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

Management Accounting 1
2579900, SS 2024, 2 SWS, Language: English, Open in study portal
Content
The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA1 are: short-term planning, investment decisions, budgeting and activity-based costing.

We will use international material written in English.

We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).

The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

Learning objectives:

- Students have an understanding of theory and applications of management accounting topics.
- They can use financial information for various purposes in organizations.

Examination:

- The assessment consists of a written exam (120 minutes) at the end of each semester (following § 4 (2) No. 1 of the examination regulation).

Workload:

- The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

- In addition, several papers that will be available on ILIAS.
3.226 Course: Management and Strategy [T-WIWI-102629]

**Responsible:** Prof. Dr. Hagen Lindstädt

**Organisation:** KIT Department of Economics and Management

**Part of:** M-MACH-104884 - Courses of the KIT Department of Economics and Management

<table>
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The assessment consists of a written exam (60 min) taking place at the beginning of the recess period (according to §4 (2)), 1 of the examination regulation. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**

None

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

**V Strategic Management**

2577900, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

On-Site
Content
Students learn central concepts of strategic management along the ideal-typical strategy process. An overview of fundamental frameworks and models will be provided and an action-oriented integration performance will be achieved through the transfer of theory to practical issues.

Through intensive exposure to real-world case studies, students will be encouraged to learn and apply strategic measures in a targeted manner in the real business world. The course features an action-oriented approach and provides students with a realistic understanding of the possibilities and limitations of rational design approaches.

Content in Keywords:

- Corporate governance and strategic management: concepts, levels, process.
- Strategic analysis: internal and external analysis
- Competitive strategy: formulation, evaluation and selection of strategic action alternatives at business unit level
- Strategic interaction and strategic commitment
- Corporate strategy: diversification strategy, M&A and management of the corporate portfolio
- Implementation of strategies in companies

Structure:
Lectures in the course are available to students online as recordings, while class dates are reserved for active discussion of real-world case studies.

Learning Objectives:
Upon completion of the course, students will be able to,

- Prepare strategic decisions along the ideal strategic process in a practical setting,
- Identify sources of competitive advantage,
- Explain interrelationships of companies in competition,
- Evaluate the portfolio management of companies,
- To classify actions and decisions of companies strategically,
- Apply knowledge from theoretical frameworks to the analysis of real-life situations.

Recommendations:
None.

Workload:
Total workload for 3.5 credit hours: approximately 105 hours.

Attendance: 30 hours
Self-study: 75 hours

Verification:
Depending on further pandemic developments, the examination will be offered in the summer semester 2021 either as an open-book examination (examination performance of another kind according to SPO § 4 Abs. 2, Pkt. 3), or as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1).

It is expected that the exam will take place at the beginning of the semester's lecture-free period. The examination is offered every semester and can be repeated at any regular examination date.

Literature


Die relevanten Auszüge und zusätzliche Quellen werden in der Veranstaltung bekannt gegeben.
### 3.227 Course: Manufacturing Technology [T-MACH-102105]

**Responsible:** Prof. Dr.-Ing. Volker Schulze  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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<th>Module Name</th>
<th>SWS</th>
<th>Lecture / Practice (Online/Blended)</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>6</td>
<td>Manufacturing Technology</td>
<td>2149657</td>
<td>Lecture / Practice (VÜ)</td>
<td>Schulze</td>
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**Exams**

<table>
<thead>
<tr>
<th>Exams</th>
<th>Credits</th>
<th>Module Name</th>
<th>Responsible</th>
</tr>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>6</td>
<td>Manufacturing Technology</td>
<td>Schulze</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Written Exam (180 min)

**Prerequisites**

none

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

**Manufacturing Technology**

2149657, WS 23/24, 6 SWS, Language: German, [Open in study portal](#)

Lecture / Practice (VÜ)

Blended (On-Site/Online)
Content
The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.

The following topics will be covered:

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

This lecture provides an excursion to an industry company.

Learning Outcomes:
The students ...

- are capable to specify the different manufacturing processes and to explain their functions.
- are able to classify the manufacturing processes by their general structure and functionality according to the specific main groups.
- have the ability to perform a process selection based on their specific characteristics.
- are enabled to identify correlations between different processes and to select a process regarding possible applications.
- are qualified to evaluate different processes regarding specific applications based on technical and economic aspects.
- are experienced to classify manufacturing processes in a process chain and to evaluate their specific influence on surface integrity of workpieces regarding the entire process chain.

Workload:
regular attendance: 63 hours
self-study: 177 hours

Organizational issues
Vorlesungstermine montags und dienstags, Übungstermine mittwochs. Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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/).
3.228 Course: Materials Characterization [T-MACH-110946]

Responsible: Dr.-Ing. Jens Gibmeier
Prof. Dr. Reinhard Schneider

Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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<td>Each winter term</td>
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Events

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<tr>
<td>WT 23/24</td>
<td>2173431</td>
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<td>2 SWS</td>
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Exams

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<tr>
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<th>Type</th>
<th>Grading scale</th>
<th>Recurrence</th>
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<td>76-T-MACH-110946</td>
<td>Materials Characterization</td>
<td>Gibmeier</td>
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</tr>
</tbody>
</table>

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

Competence Certificate

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 Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-110945 - Exercises for Materials Characterization must have been passed.
2. The course T-MACH-107685 - Exercises for Materials Characterization must not have been started.
3. The course T-MACH-107684 - Materials Characterization must not have been started.

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

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.

Organizational issues

Start am 31.10.2023

Literature

Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).
Literatur wird zu Beginn der Veranstaltung bekanntgegeben.
### 3.229 Course: Materials Characterization [T-MACH-107684]

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

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

**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 4

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<tr>
<td>ST 2024</td>
<td>2 SWS</td>
<td>Lecture / 🗣️ Gibmeier, Peterlechner</td>
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**Exams**

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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2 SWS</td>
<td>Lecture / 🗣️ Gibmeier</td>
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</table>

**Legends:**  
🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**  
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 Conditions**  
The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must have been passed.
2. The course T-MACH-110945 - Exercises for Materials Characterization must not have been started.
3. The course T-MACH-110946 - Materials Characterization must not have been started.

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

<table>
<thead>
<tr>
<th>Materials Characterization</th>
<th>Lecture (V)</th>
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<tbody>
<tr>
<td>2174586, SS 2024, 2 SWS, Language: German, Open in study portal</td>
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</tbody>
</table>

**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.
3.230 Course: Materials Modelling: Dislocation Based Plasticity [T-MACH-105369]

Responsible: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Version</th>
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Events

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<td>ST 2024</td>
<td>2182740</td>
<td>Materials modelling: dislocation based plasticy</td>
<td>2 SWS</td>
<td>Lecture</td>
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Exams

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<td>Weygand</td>
<td>Lecture / On-Site</td>
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<td>ST 2024</td>
<td>76-T-MACH-105369</td>
<td>Materials Modelling: Dislocation Based Plasticity</td>
<td>Weygand</td>
<td>Lecture / On-Site</td>
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</table>

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

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowledge in mathematics, physics and materials science

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

Materials modelling: dislocation based plasticity
2182740, SS 2024, 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
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 knowledge in mathematics, physics and materials science recommended.

Regular attendance: 22.5 hours
Self-study: 97.5 hours
Oral exam ca. 30 minutes
Literature

3.231 Course: Materials of Lightweight Construction [T-MACH-105211]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Each summer term</td>
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</table>

**Events**

| ST 2024 | 2174574 | Materials of Lightweight Construction | 2 SWS | Lecture / 🗣 | Liebig |

**Exams**

| WT 23/24 | 76-T-MACH-105211 | Materials of Lightweight Construction | Liebig |

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

**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

none

**Recommendation**

Materials Science I/II

*Below you will find excerpts from events related to this course:*
Content
Introduction
Constructive, production-orientied and material aspects of lightweight construction
- Aluminium-based alloys
- Aluminium wrought alloys
- Aluminium cast alloys
- Magnesium-based alloys
- Magnesium wrought alloys
- Magnesium cast alloys
- Titanium-based alloys
- Titanium wrought alloys
- Titanium cast alloys
- High-strength steels
- High-strength structural steels,
- Heat-treatable steels, press-hardening and hardenable steels
- Composites - mainly PMC
- Matrices
- Reinforcements
- Basic mechanical principles of composites
- Hybrid composites
- Special materials for lightweight design
- Beryllium alloys
- Metallic Glasses
- Applications

learning objectives:
The students are capable to name different lightweight materials and can describe their composition, properties and fields of application. They can describe the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.
The students can apply basic mechanical models of composites and can depict differences in the mechanical properties depending on composition and structure. The students can describe the basic principle of hybrid material concepts and can judge their advantages in comparison to bulk materials. The students can name special materials for lightweight design and depict differences to conventional materials. The students have the ability to present applications for different lightweight materials and can balance reasons for their use.

requirements:
Werkstoffkunde I/II (recommended)

workload:
The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

Examination:
Oral examination, Duration approx. 25 min

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung
3.232 Course: Materials Physics and Metals [T-MACH-100285]

**Responsible:** Prof. Dr.-Ing. Martin Heilmair  
Prof. Dr. Astrid Pundt

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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<tr>
<td>WT 23/24</td>
<td>Materials Physics</td>
<td>3 SWS</td>
<td>Lecture / 🗣️</td>
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<td>ST 2024</td>
<td>Metals</td>
<td>4 SWS</td>
<td>Lecture / 🗣️</td>
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<tr>
<td>ST 2024</td>
<td>Exercises in Metals</td>
<td>1 SWS</td>
<td>Practice / 🗣️</td>
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**Exams**

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<td>Gruber, Pundt</td>
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</table>

**Competition Certificate**

Oral exam, about 45 minutes

**Prerequisites**

none

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

**Metals**

2174598, SS 2024, 4 SWS, Language: German, Open in study portal

**Content**

Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

**Learning objectives:**

The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanics and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.

**Requirements:**

Materials physics  
workload:

Regular attendance: 42 h  
Self-study: 138 h

**Organizational issues**

Weitere Informationen zu dieser Veranstaltung finden Sie hier: [https://www.iam.kit.edu/wk/lehre.php](https://www.iam.kit.edu/wk/lehre.php)

**Literature**

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001  
H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005  
J. Freudenberger: [http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe](http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe)
Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

Learning objectives:
The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanical and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

Requirements:
Lecture and Tutorials on Materials Physics as well as the lecture on Metals

Workload:
Regular attendance: 14 h
Self-study: 16 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)
### 3.233 Course: Materials Processing Technology [T-MACH-100295]

**Responsible:** Dr. Joachim Binder  
Dr.-Ing. Wilfried Liebig  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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#### Events

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<td>3 SWS</td>
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<tr>
<td>WT 23/24 2173541</td>
<td>1 SWS</td>
<td>Materials Processing Lab Course</td>
<td>Liebig, Binder</td>
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#### Exams

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<th>Type</th>
<th>Lecturer</th>
</tr>
</thead>
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<tr>
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<td></td>
<td>Materials Processing Technology</td>
<td>Liebig, Binder</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Oral exam (lecture + lab course), approx. 25 min, lab course "Materials Processing" has to be finished successfully.

**Prerequisites**

Lab course "Materials Processing" has to be passed successfully in advance.

**Annotation**

Lecture: lecture notes, slides + beamer, blackboard  
Lab course: experimental equipment, paper, pencil, lab course notes, calculator

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

#### Materials Processing Technology

2173540, WS 23/24, 3 SWS, Language: German, [Open in study portal](#)  
Lecture / Practice (VÜ)  
On-Site
Content
Introduction
Polymers:
Raw materials, materials laws and models, rheology, moulding, forming, joining
Ceramics:
raw materials, powder synthesis, additives, moulding and forming of glass, moulding, abrasive techniques, changing properties, final processing
metals:
raw materials, materials processing, moulding, forming, cutting, joining
semiconductors:
raw materials, moulding, changing properties

Summary
objectives:
The students are able to name the different materials processing techniques and can describe their basic principles and allocate them to the different classes of materials processing methods.
They can choose specific processing techniques based on given problems and consider constraints derived from their basic knowledge in materials science.
The students are able to carry out simple experiments with lab scale equipment. They can correlate the processing parameters with resulting material properties by analyzing the materials using adequate testing methods which have to be chosen, evaluated and documented suitable to the problems given.
requirements:
none, Recommendations: Module "Basics in Materials Science" should be passed

workload:
The workload for the study program MatWerk for the lecture “materials processing technology” is 180 h per semester and consists of the presence during the lectures (36 h) including tutorials, presence during the lab course (12 h), preparation and rework time at home (72 h) and preparation time for the oral exam (60 h).
The workload for the study program Mechanical Engineering for the lecture “materials processing technology” is 120 h per semester and consists of the presence during the lectures (36 h) including tutorials, preparation and rework time at home (24 h) and preparation time for the oral exam (60 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung
Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given
3.234 Course: Materials Science and Engineering III [T-MACH-105301]

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

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

Type: Oral examination  Credits: 8  Grading scale: Grade to a third  Recurrence: Each winter term  Version: 2

Events

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<tr>
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<td>Materials Science and Engineering III</td>
<td>4 SWS</td>
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<td>Heilmaier, Guth</td>
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<td>WT 23/24</td>
<td>2173554</td>
<td>Exercises in Materials Science and Engineering III</td>
<td>1 SWS</td>
<td>Practice / 🗣️</td>
<td>1 SWS</td>
<td>Heilmaier, Kauffmann</td>
</tr>
</tbody>
</table>

Exams

<table>
<thead>
<tr>
<th>Event</th>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Type</th>
<th>Credits</th>
<th>Lecturer</th>
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</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>76-T-MACH-105301</td>
<td>Materials Science III</td>
<td></td>
<td></td>
<td></td>
<td>Heilmaier, Guth</td>
</tr>
</tbody>
</table>

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

Competence Certificate
Oral exam, about 35 minutes

Prerequisites
T-MACH-110818 - Plasticity of Metals and Intermetallics has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110818 - Plasticity of Metals and Intermetallics must not have been started.

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

Materials Science and Engineering III
2173553, WS 23/24, 4 SWS, Language: German, Open in study portal

Lecture (V)  On-Site

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatments.

requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

workload:
regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
3.235 Course: Mathematical Methods in Continuum Mechanics [T-MACH-110375]

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

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
<td>1 terms</td>
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Events

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<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<tr>
<td>WT 23/24</td>
<td>2161254</td>
<td>Mathematical Methods in Continuum Mechanics</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
<td>Böhlke</td>
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Exams

<table>
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<th>Credits</th>
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<td>Mathematical Methods in Continuum Mechanics</td>
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<td>Böhlke</td>
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</table>

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

Competence Certificate
written exam (90 min). Additives as announced.

Prerequisites
Passing the Tutorial to Mathematical Methods of Continuum Mechanics (T-MACH-110376)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110376 - Tutorial Mathematical Methods in Continuum Mechanics must have been passed.

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

Mathematical Methods in Continuum Mechanics
2161254, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
Tensor algebra

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

Application of tensor calculus in strength of materials

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

Literature
Vorlesungsskript
Schade, H.: Strömungslehre, de Gruyter 2013
Course: Mathematical Methods in Dynamics [T-MACH-105293]

**Responsible:** Prof. Dr.-Ing. Carsten Proppe

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**
Written examination

**Credits**
6

**Grading scale**
Grade to a third

**Recurrence**
Each winter term

**Version**
2

<table>
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<td>WT 23/24</td>
<td>2161206</td>
<td>Mathematical Methods in Dynamics</td>
<td>2 SWS</td>
<td>Lecture / 📞 Proppe</td>
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<tr>
<td>WT 23/24</td>
<td>2161207</td>
<td>Übungen zu Mathematische Methoden der Dynamik</td>
<td>1 SWS</td>
<td>Practice / 📝 Proppe, Bitner</td>
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<td>ST 2024</td>
<td>2161206</td>
<td>Mathematical Methods in Dynamics</td>
<td>2 SWS</td>
<td>Lecture / 📞 Proppe</td>
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**Exams**

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<td>Mathematical Methods in Dynamics</td>
<td></td>
<td>Proppe</td>
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</table>

**Legends:**
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗣 On-Site
- ☓️ Cancelled

**Competence Certificate**

written examination, 180 min.

**Prerequisites**

none

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

**Mathematical Methods in Dynamics**

2161206, WS 23/24, 2 SWS, Language: German, Open in study portal

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

**Content**

Dynamics of continua:
Concept of continua, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Principle of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

**Literature**

Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993


The students know precisely the mathematical methods of dynamics. They are able to use the basic mathematical methods for modelling the dynamical behaviour of elastic and rigid bodies. The students also have a basic understanding of the description of kinematics and kinetics of bodies. They also master the alternative formulations based on weak formulations and variational methods and the approximate solution methods for numerical calculations of the moving behaviour of elastic bodies.

Dynamics of continua:
- Concept of continuum, geometry of continua, kinematics and kinetics of continua

Variational principles:
- Principle of virtual work, variational calculations, Principle of Hamilton

Approximate solution methods:
- Methods of weighted residuals, method of Ritz

Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993


### 3.237 Course: Mathematical Methods in Fluid Mechanics [T-MACH-105295]

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

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

<table>
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<th>SWS</th>
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<td>2154432</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>4</td>
<td>Lecture / Practice (🖥️)</td>
<td>Gatti, Frohnapfel</td>
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<td>ST 2024</td>
<td>2154540</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>4</td>
<td>Lecture / Practice (🖥️)</td>
<td>Gatti, Frohnapfel</td>
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**Exams**

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<tr>
<th>Exam</th>
<th>Code</th>
<th>Subject</th>
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<tr>
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<td>76-T-MACH-105295</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>Frohnapfel</td>
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<tr>
<td>WT 23/24</td>
<td>76-T-MACH-105295 (engl.)</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>Frohnapfel, Gatti</td>
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<td>ST 2024</td>
<td>76-T-MACH-105295</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>Frohnapfel, Gatti</td>
</tr>
<tr>
<td>ST 2024</td>
<td>76-T-MACH-105295 (engl.)</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>Gatti, Frohnapfel</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**
- written examination - 3 hours

**Prerequisites**
- none

**Recommendation**
- Basic Knowledge about Fluid Mechanics

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

#### Mathematical Methods in Fluid Mechanics

- **2154432, SS 2024, 4 SWS, Language: German/English, Open in study portal**  
  **Lecture / Practice (VÜ)**  
  **Blended (On-Site/Online)**

**Content**

The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

**Organizational issues**

Mathematical Methods in Fluid Mechanics
2154540, SS 2024, 4 SWS, Language: English, Open in study portal

Content
The students can simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical methods in fluid mechanics effectively in order to solve the resulting governing equations analytically, if possible, or to enable simpler numerical solution of the problem. The students can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Creeping flows (Stokes flow)
- Lubrication theory
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows

Literature
3.238 Course: Mathematical Methods in Micromechanics [T-MACH-110378]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Type</th>
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<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>1 terms</td>
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Events

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

Competence Certificate
written exam (180 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 Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110379 - Tutorial Mathematical Methods in Micromechanics must have been passed.

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

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

Organizational issues
Nähere Informationen zu Zeit und Ort der Vorlesung im SS 2023: siehe ITM-KM Homepage

Literature
- Vorlesungsskrift
- Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)
Module Handbook as of 23/02/2024
3.239 Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
Dr.-Ing. Ulrich Römer  

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<th>Lecture</th>
<th>Practice</th>
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<td>Mathematical methods of vibration theory</td>
<td>Lecture / x</td>
<td>Römer</td>
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<td>ST 2024</td>
<td>2162242</td>
<td>Mathematical methods of vibration theory (Tutorial)</td>
<td>Practice / x</td>
<td>Keller, Römer</td>
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**Exams**

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<th>Title</th>
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<td>76-T-MACH-105294</td>
<td>Mathematical Methods of Vibration Theory</td>
<td>Fidlin</td>
</tr>
<tr>
<td>ST 2024</td>
<td>76-T-MACH-105294</td>
<td>Mathematical Methods of Vibration Theory</td>
<td>Fidlin</td>
</tr>
</tbody>
</table>

**Competence Certificate**
written examination, 180 min.

**Prerequisites**
none

**Recommendation**
Engineering Mechanics III/IV

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

**Lecture (V)**

<table>
<thead>
<tr>
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<th>Title</th>
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<tr>
<td>2162241</td>
<td>Mathematical methods of vibration theory</td>
<td>2 SWS</td>
<td>German</td>
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**Practice (Ü)**

<table>
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<th>Title</th>
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<tbody>
<tr>
<td>2162242</td>
<td>Mathematical methods of vibration theory (Tutorial)</td>
<td>2 SWS</td>
<td>German</td>
<td>Open in study portal</td>
</tr>
</tbody>
</table>

**Content**
Linear, time-invariant, ordinary single differential equations: homogeneous solution; harmonic, periodic and non-periodic excitations; Duhamel's integral; Fourier and Laplace transform; introduction into the theory of distributions; Systems of ordinary differential equations: matrix notation, eigenvalue theory, fundamental matrix, forced vibrations via modal expansion and transition matrix; Introduction into the dynamic stability theory; Partial differential equations: solution in product form, eigenvalue theory, modal expansion using Ritz series; Variational methods, Hamilton's principle, boundary value problems representing vibrating continua; Perturbation methods

**Organizational issues**
Die Vorlesung und Übungen zu Mathematische Methoden der Schwingungslehre werden im Sommersemester 2024 nicht angeboten.

**Literature**
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

**Practice (Ü)**

<table>
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<td>2162242</td>
<td>Mathematical methods of vibration theory (Tutorial)</td>
<td>2 SWS</td>
<td>German</td>
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</table>

**Content**
Seven tutorials with examples of the contents of the course

**Organizational issues**
Die Vorlesung und Übungen zu Mathematische Methoden der Schwingungslehre werden im Sommersemester 2024 nicht angeboten.
Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik
3.240 Course: Mathematical Models and Methods for Production Systems [T-MACH-105189]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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<td>Grade to a third</td>
<td>Each winter term</td>
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**Exams**

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<td>Lecture / Practice (V/U)</td>
<td>Baumann, Furmans</td>
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</table>

**Competence Certificate**

The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**
none

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

**Mathematical models and methods for Production Systems**

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Lecture / Practice (V/U)</td>
<td>Baumann, Furmans</td>
<td>1</td>
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</tbody>
</table>

**Content**

**Media:**
black board, lecture notes, presentations

**Learning Content:**

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

**Learning Goals:**

Students are able to:

- Describe queueing systems with analytical solvable stochastic models,
- Derive approaches for modeling and controlling material flow and production systems based on models of queueing theory,
- Use simulation and exakt methods.

**Recommendations:**

- Basic knowledge of statistic
- recommended compulsory optional subject: Stochastics
- recommended lecture: Materials flow in logistic systems (also parallel)

**Workload:**

- regular attendance: 42 hours
- self-study: 198 hours
Organizational issues

- Im Wintersemester 2023/2024 ist die Veranstaltung auf maximal 30 Teilnehmer beschränkt.
- Die Anmeldung ist durch Beitritt zum ILIAS-Kurs und Ausfüllen des Anmeldungsformulars (erforderliche Felder beim Beitritt zum ILIAS-Kurs) möglich.
- Die Anmeldung ist vom 01.09.2023 bis zum 30.09.2023 möglich.

Literature
3.241 Course: Mathematical Models and Methods in Combustion Theory [T-MACH-105419]

**Responsible:** Dr. Viatcheslav Bykov  
**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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<td>Each winter term</td>
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**Events**

| Termine und Raum: siehe Aushang und Internetseite des Instituts. |
|---|---|---|---|---|---|
| WT 23/24 | 2165525 | Mathematical models and methods in combustion theory | 2 SWS | Lecture / On-Site | Bykov |

**Competence Certificate**

Oral exam, approx. 20 min

**Prerequisites**

none

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

**Mathematical models and methods in combustion theory**  
2165525, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

The lecture shall introduce the basics of the mathematical modeling and the analysis of reacting flow systems. The fundamental models of combustion processes are outlined together with asymptotical methods, which deliver reasonable approximate solutions for numerous combustion processes. Many examples of simplified models for the description of auto-ignition, explosions, flame quenching and detonations will be presented and discussed. The main analytical methods will be illustrated using these simple examples.

**Organizational issues**

Termine und Raum: siehe Aushang und Internetseite des Instituts.

**Literature**

3.242 Course: Measurement and Control Systems [T-MACH-103622]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Lecture</td>
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**Exams**

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<td>Stiller, Pauls</td>
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**Prerequisites**

none

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

**Measurement and Control Systems**

3137020, WS 23/24, 3 SWS, Language: English, [Open in study portal]

**Content**

**Lehrinhalt (EN):**

1. Dynamic systems  
2. Properties of important systems and modeling  
3. Transfer characteristics and stability  
4. Controller design  
5. Fundamentals of measurement  
6. Estimation  
7. Sensors  
8. Introduction to digital 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. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
  
  - Regelungstechnische Bücher:
    
    J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
    R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
    O. Föllinger: Regelungstechnik, Hüthig-Verlag
    W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag
  
  - Messtechnische Bücher:
    
    E. Schrüfer: Elektrische Messtechnik, Hanser-Verlag, München, 5. Aufl., 1992
    W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
    Kronmüller, H.: Prinzipien der Prozeßmesstechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

Measurement and Control Systems (Tutorial)
3137021, WS 23/24, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content

Tutorial for Measurement and Control Systems
Course: Measurement II [T-MACH-105335]

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

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

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

Competence Certificate

written exam
60 min.
2 DIN A4 Self-created formular sheets allowed

Prerequisites

none

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

Lerninhalt (EN)
1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

Lernziele (EN):
The capabilities of modern sensor technology pave the way for novel applications in engineering. Especially digital measurement techniques may be used even in very complex environments and thus have strong impact on technological progress. Stochastic models of measurement processes form the basis for meaningful information processing and provide a valuable tool for engineering. This interdisciplinary lecture addresses students in mechanical engineering and related subjects. The lecture gives an overview of digital technology and stochastics. These areas form the basics of estimation methods that can be embedded elegantly in the theory of state observers. Applications in signal processing for modern environmental perception (video, Lidar, Radar) illustrate the discussed subjects.

Nachweis:
Written exam
60 minutes
Individual sheet of formulas

Arbeitsaufwand:
120 hours
Literatur
Skript und Foliensatz zur Veranstaltung werden als kostenlose pdf-Dateien bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

Idealerweise haben Sie zuvor 'Grundlagen der Mess- und Regelungstechnik' gehört oder verfügen aus einer Vorlesung anderer Fakultäten über grundlegende Kenntnisse der Mess- und Regelungstechnik und der Systemtheorie.
3.244 Course: Measurement Instrumentation Lab [T-MACH-105300]

**Responsible:** Marvin Klemp
Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚙ On-Site, ✗ Cancelled

**Competence Certificate**

Non graded colloquia

**Prerequisites**

none

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

**Measurement Instrumentation Lab**

2138328, SS 2024, 2 SWS, Language: German/English, Open in study portal

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

**Content**

Please consider the bulletin on our website!

**A Signal recording**

- measurement of temperature
- measurement of lengths

**B Signal pre-processing**

- bridge circuits and principles of measurement
- analog/digital transducers

**C Signal processing**

- measuring stochastic signals

**D Complete systems**

- system identification
- inverse pendulum
- mobile robot platform

**Recommendations:**

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand: 90 hours

**Lernziele (EN):**

The laboratory complements the course "Introduction to Measurement and Control". While the course is organized into principles and subsystems, the laboratory presents complete measurement systems and methods for the most relevant industrial measurands.

**Literature**

Anleitungen auf der Homepage des Instituts erhältlich.

Instructions to the experiments are available on the institute's website.
3.245 Course: Mechanics and Strength of Polymers [T-MACH-105333]

**Responsible:** Hon.-Prof. Dr. Bernd-Steffen von Bernstorff  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

| WT 23/24 | 2173580 | Mechanics and Strengths of Polymers | 2 SWS | Lecture / 🗣 | von Bernstorff |

**Exams**

| WT 23/24 | 76-T-MACH-105333 | Mechanics and Strengths of Polymers | von Bernstorff |

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

**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

none

**Recommendation**

Basic knowledge in materials science (e.g. lecture materials science I and II)

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

**Mechanics and Strengths of Polymers**

2173580, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**On-Site**

**Content**

Molecular structure and morphology of polymers, temperature- and time dependency of mechanical behavior, viscoelasticity, time/temperature- superposition principle, yielding, crazing and fracture of polymers, failure criterions, impact and dynamic loading, corresponding principle, tough/brittle-transition, introduction to the principles of fiber reinforcement and multiple cracking in composites

**learning objectives:**

The students are prepared to

- repeat the calculus on strength and design of engineering parts exposed to complex loadings,
- estimate the influence of time and temperature on the strength of polymeric materials,
- relate the strength of materials to their molecular structure, morphology and processing parameters and
- derive failure mechanisms for homogenous polymers and composite materials therefrom.

**requirements:**

basic knowledge in materials science (e.g. lecture materials science I and II)

**workload:**

The workload for the lecture Mechanics and Strengths of Polymers is 120 h per semester and consists of the presence during the lecture (28 h) as well as preparation and rework time at home (92 h).

**Organizational issues**

berndvonbernstorff@t-online.de

**Literature**

Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben
Course: Mechanics in Microtechnology [T-MACH-105334]

**Responsible:** Prof. Dr. Christian Greiner  
Dr. Patric Gruber

**Organisation:** KIT Department of Mechanical Engineering

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

### Events

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### Exams

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<td>Gruber, Greiner</td>
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### Competence Certificate

Oral examination, ca. 30 min

### Prerequisites

none

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

**Mechanics in Microtechnology**  
2181710, WS 23/24, 2 SWS, Language: German, Open in study portal

### Lecture (V)

**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. Aktuation: 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,  
2. L.B. Freund and S. Suresh: "Thin Film Materials"  
3.247 Course: Mechanics of Laminated Composites [T-MACH-108717]

**Responsible:** Prof. Dr. Eckart Schnack

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral exam, approx. 20 minutes

**Prerequisites**

none

**Annotation**

The lecture notes are made available via ILIAS.

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

**Mechanics of laminated composites**

2161983, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

Definition of composites, definition of static and kinematic groups. Definition of material laws. Transformation of the state values of composites and transformation of the material properties for the coordinate systems in the design of machine structures.

**Organizational issues**

Beginn ab 07.11.2023
**3.248 Course: Mechano-Informatics and Robotics [T/INFO-101294]**

**Responsible:** Prof. Dr.-Ing. Tamim Asfour

**Organisation:** KIT Department of Informatics

**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

### Events

<table>
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**Exams**

| WT 23/24 | 7500176 | Mechano-Informatics and Robotics | Asfour |

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

**Competence Certificate**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

None.

**Recommendation**

Basispraktikum Mobile Roboter

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

**Mechano-Informatics and Robotics**

2400077, WS 23/24, 2 SWS, Language: German/English, Open in study portal

**Lecture (V)**

On-Site

**Content**

The lecture addresses various engineering and algorithmic aspects and topics in robotics which are illustrated and explained based on examples originating from current research conducted in the field of humanoid robotics. First, this lecture gives an introduction into the mathematical fundamentals which are needed to describe a robotic system as well as the basic algorithms commonly applied in motion planning. Subsequently, models and methods are introduced with which dynamical systems can be formalized and which can be used to encode and represent robot actions. To do so, we will discuss linear time-invariant systems in state.

**Learning Objectives:**

Based on the example of robotics students understand the synergistic effects and interdisciplinarity of mechatronics and informatics, the embedded systems, the control, and the methods and the algorithms. They are acquainted with the basic terminology and the methods which are common in robotics, signal processing, action representation, machine learning and cognitive systems. They are capable of applying fundamental state-of-the-art methods and tools for the development and programming of robots. Based on examples originating from current research conducted in the fields of humanoid robotics, the students interactively learn how to identify and formalize problems and tasks and how to develop solutions in an analytical and goal-directed way.

**Organizational issues**

Zugehörige Veranstaltungen: Empfehlung - Basispraktikum Mobile Roboter

Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung in englischer Sprache im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

**Arbeitsaufwand:**

2h Präsenz
+ 2*2h = 4h Vor/Nachbereitung
+ 30h Prüfungsvorbereitung
120h
### 3.249 Course: Mechatronical Systems and Products [T-MACH-105574]

**Responsible:** Prof. Dr.-Ing. Sören Hohmann  
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

| WT 23/24 | 76-T-MACH-105574 | Mechatronical Systems and Products | Matthiesen |

**Competition Certificate**

written examination (duration: 60min)

**Annotation**

All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey "Anmeldung und Gruppeneinteilung" in ILIAS before the start of the semester.
### 3.250 Course: Medical Imaging Technology I [T-ETIT-113048]

**Responsible:** Prof. Dr. Maria Francesca Spadea  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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#### Events

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#### Exams

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#### Competence Certificate

The examination takes place in form of a written examination lasting 60 minutes. The course grade is the grade of the written exam.

#### Prerequisites

none
3.251 Course: Medical Imaging Technology II [T-ETIT-113421]

**Responsible:** Prof. Dr. Maria Francesca Spadea

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

**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Events**

| ST 2024 | 2305262 | Medical Imaging Technology II | 2 SWS | Lecture / 🗣 | Spadea |

**Exams**

| ST 2024 | 7305262 | Medical Imaging Technology II | Spadea |

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

**Competence Certificate**

The examination takes place in form of a written examination lasting 60 minutes. The course grade is the grade of the written exam.

**Prerequisites**

none
### 3.252 Course: Metal Forming [T-MACH-105177]

**Responsible:** Prof. Dr.-Ing. Thomas Herlan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Each summer term</td>
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**Events**

| ST 2024 | 2150681 | Metal Forming | 2 SWS | Lecture / 🗣 | Herlan |

**Competence Certificate**  
Oral Exam (20 min)

**Prerequisites**  
none

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

#### 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

#### 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 Forschungfabrik (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)
3 COURSES

Course: Metallographic Lab Class [T-MACH-105447]

Responsibility: Prof. Dr.-Ing. Martin Heilmaier
Dr.-Ing. Alexander Kauffmann

Organisation: KIT Department of Mechanical Engineering

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

<table>
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Events

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<th>Recurrence</th>
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Exams

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<td>WT 23/24</td>
<td>3 SWS</td>
<td>pass/fail</td>
<td>Each term</td>
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Competence Certificate

Colloquium for every experiment, about 60 minutes, protocol

Prerequisites

none

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

Metallographic Lab Class

2175590, WS 23/24, 3 SWS, Language: German, Open in study portal

Practical course (P)

On-Site

Content

The lab course deals with the practical application of metallographic procedures, e.g. starting from sample extraction to light optical (LOM) and scanning electron microscopy (SEM). The preparation of metallographic samples takes up to two lab days. LOM and SEM analyses are performed on another two days. All results are carefully registered by the students and discussed in a separate session. Finally, the students can independently apply their theoretical and practical knowledge by the preparation and analysis of industrial relevant metallic materials. The content of the lab course will be documented in the form of individual protocols by the students.

Before starting with the lab course, the students need to prepare the fundamentals that are tested in an online test. Lecture notes as starting point are provided.

Learning objectives:

The students can perform standard metallographic preparation routines as well as qualitative and quantitative microstructure analysis. The students are able to interpret microstructures and the correlations of microstructural constituent and processing and properties of metallic materials.

Prerequisites:

Materials Science and Engineering I and II or Materials Physics und Metals

Arbeitsaufwand:

on-site: 25 h
private studies: 95 h
Literature
Praktikumsskript
Weiterführende Informationen gibt es hier:

http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)

https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606610

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)

http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)
Course: Metals [T-MACH-105468]

**Responsible:** Prof. Dr.-Ing. Martin Heilmair
Prof. Dr. Astrid Pundt

**Organisation:** KIT Department of Mechanical Engineering

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

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

**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

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

**Metals**

2174598, SS 2024, 4 SWS, Language: German, Open in study portal

**Content**

Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

**learning objectives:**

The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanical and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.

**requirements:**

Materials physics

**workload:**

Regular attendance: 42 h
Self-study: 138 h

**Organizational issues**

Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

**Literature**

E. Hornbogen, H. Wartlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001
H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005
J. Freudenberger: http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe

**Exercises in Metals**

2174599, SS 2024, 1 SWS, Language: German, Open in study portal
Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

Learning objectives:
The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanics and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

Requirements:
Lecture and Tutorials on Materials Physics as well as the lecture on Metals

Workload:
Regular attendance: 14 h
Self-study: 16 h

Organizational issues
Weitere Informationen zu dieser Veranstaltung finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

Literature
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften
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http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)
3.255 Course: Methods and Processes of PGE - Product Generation Engineering [T-MACH-109192]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Norbert Burkardt  
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Written examination

**Credits**  
6

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

### Events

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### Exams

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

### Competence Certificate

Written exam (processing time: 120 min + 10 min reading time)

**Auxiliaries:**

- Calculator
- German dictionary (books only)

### Prerequisites

None

### Annotation

This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

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

Note:
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

Recommendations:
none

Workload:
regular attendance: 39 h
self-study: 141 h

Examination:
Written exam
Duration: 120 minutes (+10 minutes reading time)

Auxiliaries:
- Calculator
- German dictionary (books only)

Course content:
Basics of Product Development: Basic Terms, Classification of the Product
Development into the industrial environment, generation of costs / responsibility for costs
Concept Development: List of demands / Abstraction of the Problem Definition / Creativity Techniques / Evaluation and selection of solutions
Drafting: Prevailing basic rules of Design / Design Principles as a problem oriented accessory


Quality Assurance in early Development Phases: Methods of Quality Assurance in an overview/QFD/FMEA

Learning objectives:
The students are able to...

- classify product development in companies and differentiate between different types of product development.
- name the relevant influencing factors of a market for product development.
- name, compare and use the central methods and process models of product development within moderate complex technical systems.
- explain problem solving techniques and associated development methods.
- explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
- use design guidelines to create simple technical systems and to explain these guidelines.
- name and compare quality assurance methods; to choose and use suitable methods for particular applications.
- explain the different methods of design of experiment.
- explain the costs in development process.

Literature

Vorlesungsunterlagen
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag, 1993
### 3.256 Course: Methods of Signal Processing [T-ETIT-100694]

**Responsible:** Prof. Dr.-Ing. Michael Heizmann  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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#### Exams

| WT 23/24  | 7302113 | Methods of Signal Processing | Wahls |

**Prerequisites**

none
3.257 Course: Micro Magnetic Resonance [T-MACH-105782]

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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<th>Version</th>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚖ On-Site, ✗ Cancelled

**Competence Certificate**
Own Presentation, participation at the course discussions, result is passed or failed.

**Prerequisites**
none

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

**Micro Magnetic Resonance**

2141501, WS 23/24, 2 SWS, Language: English, [Open in study portal](#) Seminar (S) Blended (On-Site/Online)
3.258 Course: Microactuators [T-MACH-101910]

**Responsible:** Prof. Dr. Manfred Kohl  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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

**Competence Certificate**

written exam, 60 min.

**Prerequisites**

none

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

**Microactuators**  
2142881, SS 2024, 2 SWS, Language: German, Open in study portal

**Content**

- Basic knowledge in the material science of the actuation principles  
- Layout and design optimization  
- Fabrication technologies  
- Selected developments  
- Applications

The lecture includes amongst others the following topics:

- Microelectomechanical systems: linear actuators, microrelays, micromotors  
- Medical technology and life sciences: Microvalves, micropumps, microfluidic systems  
- Microrobotics: Microgrippers, polymer actuators (smart muscle)  
- Information technology: Optical switches, mirror systems, read/write heads

**Literature**

- Folienskript "Mikroaktorik"  
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004  
### Course: Microenergy Technologies [T-MACH-105557]

**Responsible:** Prof. Dr. Manfred Kohl  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

#### Type
- Oral examination

#### Credits
- 4

#### Grading scale
- Grade to a third

#### Recurrence
- Each summer term

#### Version
- 1

**Events**

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**Exams**

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**Prerequisites**

- none

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

**Microenergy Technologies**

2142897, SS 2024, 2 SWS, Language: English, Open in study portal  

**Content**

- Basic physical principles of energy conversion  
- Layout and design optimization  
- Technologies  
- Selected devices  
- Applications

The lecture includes amongst others the following topics:

- Micro energy harvesting of vibrations using different conversion principles (piezo, electrostatic, electromagnetic, etc.)  
- Thermoelectric energy generation  
- Novel thermal energy conversion principles (thermomagnetic, pyroelectric)  
- Miniature scale solar devices  
- RF energy harvesting  
- Miniature scale heat pumping  
- Solid-state cooling technologies (magneto-, electro-, mechanocalorics)  
- Power management  
- Energy storage technologies (microbatteries, supercapacitors, fuel cells)

**Literature**

- Folienskript "Micro Energy Technologies"  
3.260 Course: Microstructure-Property-Relationships [T-MACH-110931]

**Responsible:** Dr. Patric Gruber, Prof. Dr. Christoph Kirchlechner

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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**Exams**

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<th>Module</th>
<th>Event Type</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>3 SWS</td>
<td>Microstructure-Property-Relationships</td>
<td>Lecture</td>
<td>Kirchlechner, Gruber</td>
</tr>
</tbody>
</table>

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

1. The course T-MACH-110930 - Exercises for Microstructure-Property-Relationships must have been passed.

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

<table>
<thead>
<tr>
<th>Microstructure-Property-Relationships</th>
<th>Lecture (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2177020, WS 23/24, 3 SWS, Language: English, Open in study portal</td>
<td>Blended (On-Site/Online)</td>
</tr>
</tbody>
</table>

**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 and 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
3.261 Course: Microsystem Simulation [T-MACH-108383]

**Responsible:** Prof. Dr. Jan Gerrit Korvink

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
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<tr>
<td>Written exam</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Competence Certificate:**
written exam

**Prerequisites:**
none
### 3.262 Course: Mobile Machines [T-MACH-105168]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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**Events**

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<th>Credit</th>
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<tr>
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<td>Lecture</td>
<td>On-Site</td>
<td>SS 2024</td>
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<td>4 SWS</td>
<td>Geimer, Kazenwadel</td>
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**Exams**

<table>
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<th>Course Code</th>
<th>Event Code</th>
<th>Type</th>
<th>Location</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
<th>Credit</th>
<th>Lecturer</th>
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<tr>
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<td>Lecture</td>
<td>On-Site</td>
<td>SS 2024</td>
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<td>4 SWS</td>
<td>Geimer</td>
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</table>

**Legend:** 📖 Online, 📚 Blended (On-Site/Online), 🔔 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of an oral exam (45 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**

none

**Recommendation**

Knowledge in Fluid Power Systems is required. It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

**Annotation**

After completion of the course the students have knowledge of:

- a wide range of mobile machines
- operation modes and working cycles of important mobile machines
- selected subsystems and components

**Content:**

- Introduction of the required components and machines
- Basics and structure of mobile machines
- Practical insight in the development techniques

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

**Mobile Machines**

2114073, SS 2024, 4 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

On-Site

**Content**

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

Knowledge in Fluid Power is required.

**Recommendations:**

It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

- regular attendance: 42 hours
- self-study: 184 hours
3.263 Course: Modeling and Simulation [T-MACH-105297]

**Responsible:**
Prof. Dr.-Ing. Kai Furmans  
Prof. Dr.-Ing. Marcus Geimer  
Prof. Dr.-Ing. Luise Kärger  
Prof. Dr.-Ing. Carsten Proppe

**Organisation:**  
KIT Department of Mechanical Engineering

Institute of Thermal Turbomachinery

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

<table>
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<td>2185227</td>
<td>Modelling and Simulation</td>
<td>2</td>
<td>Lecture</td>
<td>Proppe, Furmans, Geimer, Kärger</td>
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<tr>
<td>WT 23/24</td>
<td>2185228</td>
<td>Modelling and Simulation</td>
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<td>Practice</td>
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**Exams**

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<td>Modeling and Simulation</td>
<td>Furmans, Geimer, Kärger, Proppe</td>
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<td>ST 2024</td>
<td>76-T-MACH-105297</td>
<td>Modeling and Simulation</td>
<td>Geimer, Furmans, Proppe, Kärger</td>
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</tbody>
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Legend: 🖥 Online, 🛠 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment consists of a 180 minutes written examination.

**Prerequisites**
one

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

### Modelling and Simulation

**2185227, WS 23/24, 2 SWS, Language: German/English, Open in study portal**

#### Content
Introduction: Overview, concept formation, simulation studies, time/event-discrete models, event-oriented/process orientated/transaction-oriented view, typical model classes (operation/maintenance, storekeeping, loss-susceptible systems)

Time-continuous models with concentrated parameters, model characteristics and model analysis. Numerical treatment of ordinary differential equations and differential-algebraic sets of equations coupled simulations with concentrated parameters

Time-continuous models with distributed parameters, description of systems by means of partial differential equations, model reduction, numerical solution procedures for partial differential equations

#### Organizational issues

Important note: in even winter semesters (e.g. WS2022/23) the course is held in English language, in odd winter semesters (e.g. WS2023/24) in German language. The exam is bilingual.

#### Literature
Keine.
3.264 Course: Modeling of Thermodynamical Processes [T-MACH-105396]

Responsible: Prof. Dr. Ulrich Maas  
Dr.-Ing. Robert Schießl

Organisation: KIT Department of Mechanical Engineering

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

<table>
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<td>Schießl</td>
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<td>Maas, Schießl</td>
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Exams

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<tr>
<th>Exams</th>
<th>Code</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>76-T-MACH-105396</td>
<td>Maas</td>
</tr>
</tbody>
</table>

Competence Certificate

Oral exam, approx. 30 min

Prerequisites

none

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

**Content**

Principles of modelling: Representation of physical systems by equations  
Numerical solution strategies for nonlinear equation systems  
Optimization  
Constrained Optimization  
Ordinary and partial differential equations  
Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)

**Literature**

Vorlesungsskript  
Numerical Recipes C, FORTRAN; Cambridge University Press  
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973  
J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage

**Content**

Thermodynamic basics  
Numerical solver strategies for algebraic equations  
Optimization issues  
Ordinary and partial differential equations  
Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)
Literature
Vorlesungsskript
Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973
J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage
3.265 Course: Modeling of Turbulent Flows - RANS and LES [T-BGU-110842]

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann

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

**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

<table>
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<th>Recurrence</th>
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<td>Each term</td>
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<td>6221911</td>
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**Exams**

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<td>Uhlmann</td>
</tr>
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</table>

**Competence Certificate**
oral exam, appr. 45 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 3.266 Course: Modelling and Simulation [T-MACH-100300]

**Responsible:** Prof. Dr. Peter Gumbsch  
Prof. Dr. Britta Nestler  

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

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<tr>
<td>2183703</td>
<td>Numerical methods and simulation techniques</td>
<td>Written examination</td>
<td>3 SWS</td>
<td>Lecture / Practice (L)</td>
<td>Nestler, August, Prahs</td>
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<tr>
<td>2183703</td>
<td>Modelling and Simulation</td>
<td>Lecture / Practice (VÜ)</td>
<td>2+1 SWS</td>
<td>Nestler, August, Prahs</td>
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**Exams**

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Event Name</th>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
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<tr>
<td>76-T-MACH-100300</td>
<td>Modelling and Simulation</td>
<td>Lecture / Practice (VÜ)</td>
<td>Nestler, August, Prahs</td>
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</table>

**Competence Certificate**

Successful participation in the computer internship (ungraded) and written exam, 90 min (graded)

**Prerequisites**

none

**Recommendation**

preliminary knowledge in mathematics, physics and materials science

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

#### Numerical methods and simulation techniques

2183703, WS 23/24, 3 SWS, Language: German, [Open in study portal](#)

**Lecture / Practice (VÜ) On-Site**

**Content**

The course gives an introduction to modelling and simulation techniques. The following topics are included:

- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises  
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes
**Organizational issues**
Termine für Rechnerübungen werden in der Vorlesung bekannt gegeben!

**Literature**


---

**Modelling and Simulation**

2183703, SS 2024, 2+1 SWS, Language: German, [Open in study portal]

**Lecture / Practice (VÜ)**

**On-Site**

---

**Content**

The course gives an introduction to modelling and simulation techniques.

The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can
- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

Preliminary knowledge in mathematics, physics and materials science recommended

Regular attendance: 22.5 hours lecture, 11.5 hours exercises

Self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

Written examination: 90 minutes

---

**Organizational issues**


---

**Literature**

### 3.267 Course: Modelling of Microstructures [T-MACH-105303]

**Responsible:** Dr. Anastasia August  
Prof. Dr. Britta Nestler  

**Organisation:** KIT Department of Mechanical Engineering  

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

<table>
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<td>Each winter term</td>
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**Events**

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<tr>
<td>WT 23/24</td>
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<td>Modelling of Microstructures</td>
<td>3 SWS</td>
<td>Lecture / Practice ( /</td>
<td>August, Prahs, Nestler</td>
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<td>ST 2024</td>
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<td>Modelling of Microstructures</td>
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<td>August, Nestler, Weygand</td>
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</tbody>
</table>

**Competence Certificate**
oral exam 30 min  

**Prerequisites**
none  

**Recommendation**
materials science  
fundamental mathematics  

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

**Modelling of Microstructures**

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture / Practice (VÜ)</td>
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</tbody>
</table>

**Content**

- Brief Introduction in thermodynamics  
- Gibbs free energy and phase diagrams  
- Free energy functional  
- Phasefield equation  
- Driving forces  
- Grand chemical potential functional and the evolution equations  
- Numeric solution of the phasefield equation  

The student can

- explain the thermodynamic and statistical foundations for liquid-solid and solid-solid phase transition processes and apply them to construct phase diagrams.  
- explain the mechanisms of phase boundary motion induced under driving forces  
- use the phase-field method for simulation of microstructure formation processes  
- have experiences in computing and conduction simulations of microstructure formation from an integrated computer lab.  

Knowledge in materials science and in fundamental mathematics recommended  

regular attendance: 22.5 hours lecture, 11.5 hours exercises  
self-study: 116 hours  
oral exam ca. 30 min
Organizational issues
Der erste Termin (am 27.10.2023) findet ausnahmsweise ohne die Dozentin statt. Bitte schauen Sie sich an diesem Termin die erste Aufzeichnung der Vorlesung an (s. das entsprechende Verzeichnis bei ILIAS).
Terminvereinbarung für die mündliche Prüfung: Sobald Sie wissen, wann Sie die Prüfung ablegen möchten, schreiben Sie bitte eine Mail an die Prüferin Anastasia August (anastasia.august2@kit.de) und schlagen Sie einen oder mehrere Termin/e vor. Die Prüfung dauert ca. 30 Minuten.

Literature
4. Gaskell, D.R., Introduction to the thermodynamics of materials
### 3.268 Course: Modern Control Concepts I [T-MACH-105539]

**Responsible:** apl. Prof. Dr. Lutz Groell  
apl. Prof. Dr. Jörg Matthes  

**Organisation:** KIT Department of Mechanical Engineering

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

**Events**

<table>
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**Exams**

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**Prerequisites**

none

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

**Modern Control Concepts I**

2105024, SS 2024, 2 SWS, Language: German, Open in study portal

**Tutorial on Modern Control Concepts I**

2106020, SS 2024, 2 SWS, Language: German, Open in study portal

**Literature**


**Content**

**Learning Content:**

1. Introduction (system classes, nomenclature)
2. Equilibra
3. Linearization (software based, Hartman-Grobman-Theorem)
4. Parameter identification of linear dynamic models (SISO+MIMO)
5. PID-controller (realization, design-hints, Anti-Windup-mechanisms)
6. Concept of 2DOF-Controllers (structure, reference signal design)
7. State space (geometric view)
8. Controller with state feedback and integrator expansion  
   (LQ-design, Eigenvalue placement, decoupling design)
9. Observer (LQG-design, disturbance observer, reduced observer)

**Recommendations:**

Attendance of the following lectures is recommended:

- Grundlagen der Mess- und Regelungstechnik

Alternatively: Comparable courses of the faculty of electrical engineering
Literature

**3.269 Course: Motor Vehicle Labor [T-MACH-105222]**

**Responsible:** Dr.-Ing. Michael Frey  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
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<td>Practical course / 📞 Frey</td>
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**Exams**

<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 📞 On-Site, ✗ Cancelled

**Competence Certificate**  
Colloquium before each experiment  
After completion of the experiments: written examination  
Duration: 90 minutes  
Auxiliary means: none

**Prerequisites**  
none

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

**Motor Vehicle Laboratory**  
2115808, WS 23/24, 2 SWS, Language: German, [Open in study portal]

**Content**

1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Investigation of acoustic behaviour of vehicles

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

**Learning Objectives:**  
The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.
Organizational issues

Genauer Ort und Termine sowie weitere Infos siehe Institutshomepage.

Einteilung:
- Gruppe A: Mo 14:00-15:30
- Gruppe B: Mo 16:00-17:30
- Gruppe C: Di 09:00-10:30
- Gruppe D: Di 11:00-12:30
- Gruppe E: Di 14:00-15:30
- Gruppe F: Di 16:00-17:30

Literatur

Motor Vehicle Laboratory
2115808, SS 2024, 2 SWS, Language: German, Open in study portal

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle
2. Investigation of a twin-tube and a single-tube shock absorber
3. Behavior of car tyres under longitudinal forces and lateral forces
4. Behavior of car tires on wet road surface
5. Rolling resistance, energy dissipation and high-speed strength of car tires
6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:
The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyze measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genauer Ort und Termine sowie weitere Infos siehe Institutshomepage.

Einteilung in
- Gruppe A: Mo 14:00 - 15:30
- Gruppe B: Mo 16:00 - 17:30
- Gruppe C: Di 09:00 - 10:30
- Gruppe D: Di 11:00 - 12:30
- Gruppe E: Di 14:00 - 15:30
- Gruppe F: Di 16:00 - 17:30

Literature
3.270 Course: Multi-Scale Plasticity [T-MACH-105516]

**Responsible:** Prof. Dr. Christian Greiner  
PD Dr.-Ing. Katrin Schulz

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<th>Credits</th>
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<td>Multi-scale Plasticity</td>
<td>Lecture</td>
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**Exams**

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<td>WT 23/24</td>
<td>76-T-MACH-105516</td>
<td>Multi-Scale Plasticity</td>
<td>Lecture</td>
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</table>

**Competence Certificate**
oral exam, about 30 min

**Prerequisites**
none

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

**Annotation**
- limited number of participants
- mandatory registration
- mandatory attendance

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

**Multi-scale Plasticity**
2181750, WS 23/24, 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 knowledge in mathematics, physics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours
Exam: presentation (40%), oral examination (30 min, 60%)
The maximum number of students is 14 per semester.
Organizational issues
Blockveranstaltung in 5 Blöcken, Termine und Ort werden bekannt gegeben.
Anmeldung per Email an katrin.schulz@kit.edu bis zum 24.09.2023
3.271 Course: Neutron Physics of Fusion Reactors [T-MACH-105435]

Responsible: Dr. Ulrich Fischer
Organisation: KIT Department of Mechanical Engineering

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

<table>
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<td>Grade to a third</td>
<td>Each winter term</td>
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Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none
3.272 Course: NMR Micro Probe Hardware Conception and Construction [T-MACH-108407]

**Responsible:** Prof. Dr. Jan Gerrit Korvink

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

| ST 2024 | 2142551 | NMR micro probe hardware conception and construction | 2 SWS | Practical course / 🧩 | Korvink, Jouda |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗝 On-Site, ✗ Cancelled

**Competence Certificate**
Successful participation.

**Prerequisites**
none

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

### Content
In order to prepare attendees, the following chapters will be offered, spread over the week as lecture units, and accompanying the practical work:
- Theory of magnetic resonance imaging
- The MRI probe and the principle of reciprocity
- RF resonators
- Coaxial cables and cable traps
- Tuning and matching the MRI probe
- Effects of material susceptibility
- The mechanical support of the MRI probe
- Introduction to ParaVision, the MRI imaging software.

### Organizational issues
Blockveranstaltung am CN, Bau 301, Raum 322, Anmeldung an Mazin.Jouda@kit.edu
### Course: Nonlinear Continuum Mechanics [T-MACH-111026]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
**Organisation:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

#### Competence Certificate
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 Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111027 - Tutorial Nonlinear Continuum Mechanics must have been passed.

---

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

**Nonlinear Continuum Mechanics**  
2162344, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**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**
Vorbesprechung für interessierte Studierende mit Prof. Böhlke: Di, 16.04.2024, 13:15, Raum 308.1, Geb 10.2,3 3. OG

**Literature**
- Vorlesungsskript  
Course: Novel Actuators and Sensors [T-MACH-102152]

**Responsible:** Prof. Dr. Manfred Kohl  
Dr. Martin Sommer

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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**Events**

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<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
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<td>2 SWS</td>
<td>Novel actuators and sensors</td>
<td>Kohl, Sommer</td>
<td></td>
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</tr>
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**Exams**

<table>
<thead>
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<th>Credits</th>
<th>Type</th>
<th>Grade to a third</th>
<th>Recurrence</th>
<th>Version</th>
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</tr>
</tbody>
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Legend: 📱 Online, 🗓 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

written exam, 60 minutes

**Prerequisites**

none

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

**Novel actuators and sensors**

2141865, WS 23/24, 2 SWS, Language: German, Open in study portal

**Literature**

- Vorlesungsskript "Neue Aktoren" und Folienskript "Sensoren"
- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007
### 3.275 Course: Nuclear Fusion Technology [T-MACH-110331]

**Responsible:** Dr. Aurelian Florin Badea  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Expansion</th>
<th>Version</th>
</tr>
</thead>
<tbody>
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**Exams**

<table>
<thead>
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<th>Credits</th>
<th>Grading scale</th>
<th>Expansion</th>
<th>Version</th>
</tr>
</thead>
<tbody>
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</table>

**Events**

- **WT 23/24** 2189920 Nuclear Fusion Technology 2 SWS Lecture / Blended (On-Site/Online) Badea
- **Exams**
  - **WT 23/24** 76-T-MACH-110331 Nuclear Fusion Technology 2 SWS Lecture / Blended (On-Site/Online) Badea

**Legend:** 📞 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**Competence Certificate**

oral exam, approx. 20 min.

**Prerequisites**

none

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

### Nuclear Fusion Technology

- **2189920, WS 23/24, 2 SWS, Language: English, Open in study portal**
  - **Lecture (V) Blended (On-Site/Online)**

**Content**

This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of the physics of fusion, the components of a fusion reactor and their functions. The technological requirements for using fusion technology for future commercial production of electricity and the related environmental impact are also addressed. The students are capable of giving technical assessment of the usage of the fusion energy with respect to its safety and sustainability. The students are qualified for further training in fusion energy field and for research-related professional activity.

- nuclear fission & fusion
- neutronics for fusion
- fuel cycles, cross sections
- gravitational, magnetic and inertial confinement
- fusion experimental devices
- energy balance for fusion systems; Lawson criterion and Q-factor
- materials for fusion reactors
- plasma physics, confinement
- plasma heating
- timeline of the fusion technology
- ITER, DEMO
- safety and waste management
Course: Nuclear Power and Reactor Technology [T-MACH-110332]

**Responsible:** Dr. Aurelian Florin Badea

**Organisation:** KIT Department of Mechanical Engineering

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

### Events

<table>
<thead>
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<th>Code</th>
<th>Title</th>
<th>Type</th>
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<th>Grading scale</th>
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### Exams

<table>
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<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

### Competence Certificate

oral exam, approx. 20 min.

### Prerequisites

None

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

**Nuclear Power and Reactor Technology**

2189921, WS 23/24, 3 SWS, Language: English, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

### Content

This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of reactor technology and of the major physical processes in converting nuclear power into electrical energy. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. The students are capable of understanding the advantages and disadvantages of different reactor technologies - LWR, heavy water reactors, nuclear power systems of generation IV - by using the delivered knowledge on reactor physics, thermal-hydraulics, reactor design, control, safety and requirements of the front-end and back-end of the fuel cycle. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei, enrichment, neutron flux, cross section, reaction rate, mean free path,
- chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution,
- power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV
3.277 Course: Nuclear Power Plant Technology [T-MACH-105402]

Responsible: Dr. Aurelian Florin Badea  
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
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<td>Grade to a third</td>
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Events

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<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Cheng, Schulenberg</th>
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</table>

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

Competence Certificate
oral exam, Duration: approximately 30 minutes
no tools or reference materials may be used during the exam

Prerequisites
none

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

V Nuclear Power Plant Technology  
2170460, SS 2024, 2 SWS, Language: English, Open in study portal  
Lecture (V)  
On-Site
Content
The training objective of the course is the qualification for a research-related professional activity in nuclear power plant engineering. The participants can describe the most important components of nuclear power plants and their function. You can design or modify nuclear power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of core design, design of primary and secondary systems, and of nuclear safety technologies. Based on the acquired knowledge in thermodynamics and neutron physics, they can describe and analyze the specific behavior of the nuclear power plant components and assess risks. Participants of the lecture have a trained analytical thinking and judgment in the design of nuclear power plants.

Power plants with pressurized water reactors:
Design of the pressurized water reactor

• Fuel assemblies
• Control rods and drives
• Core instrumentation
• Reactor pressure vessel and its internals

Components of the primary system

• Primary coolant pumps
• Pressurizer
• Steam generator
• Water make-up system

Secondary system:

• Turbines
• Reheater
• Feedwater system
• Cooling systems

Containment

• Containment design
• Components of safety systems
• Components of residual heat removal systems

Control of a nuclear power plant with PWR

Power plants with boiling water reactors:
Design of the boiling water reactor

• Fuel assemblies
• Control elements and drives
• Reactor pressure vessel and its internals

Containment and components of safety systems
Control of a nuclear power plant with boiling water reactors

Literature
Vorlesungsmanuskript
3.278 Course: Numerical Fluid Mechanics [T-MACH-105338]

Responsible: Dr.-Ing. Davide Gatti  
Dr.-Ing. Franco Magagnato

Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination  
Credits: 4  
Grading scale: Grade to a third  
Recurrence: Each winter term  
Version: 3

Events

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Exams

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</tr>
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</tr>
<tr>
<td>Exams</td>
<td>Gatti</td>
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</table>

Competition Certificate

oral exam - 30 minutes

Prerequisites

none

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

**Numerical Fluid Mechanics**  
2153441, WS 23/24, 4 SWS, Language: German, [Open in study portal]

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

Content

The course covers the following topics:

1. basic equations of computational fluid dynamics
2. main discretization methods for fluid mechanics problems, with focus on finite differences and finite volumes
3. boundary and initial conditions
4. mesh generation and mesh treatment
5. solution algorithms for linear and nonlinear systems of equations
6. solution strategies for the incompressible Navier-Stokes equations
7. introduction to the solution of the compressible Navier-Stokes equations
8. examples of numerical simulation in practice

Literature

3.279 Course: Numerical Fluid Mechanics with PYTHON [T-MACH-110838]

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

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

<table>
<thead>
<tr>
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Events

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Exams

<table>
<thead>
<tr>
<th>Events</th>
<th>Code</th>
<th>Type</th>
<th>Credits</th>
<th>Module</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>ST 2024</td>
<td>76-T-MACH-110838</td>
<td>Numerical Fluid Mechanics with Python</td>
<td>2 SWS</td>
<td>Frohnapfel, Gatti</td>
<td></td>
</tr>
</tbody>
</table>

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

Competence Certificate
ungraded homework

Prerequisites
none

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

**Numerical Fluid Mechanics with Python**

2154405, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

Practical course (P)
Blended (On-Site/Online)

Content
Numerical Fluid Mechanics with Phyton

- Introduction to Numerics and Matlab
- Finite-Difference-Method
- Finite-Volume-Method
- boundary conditions and initial conditions
- explicit and implicate schemes
- pressure correction
- Solving the Navier-Stokes equation numerically for 2D flow problems

Organizational issues
Bitte bis zum 26.07.24 per E-Mail anmelden sekretariat@istm.kit.edu.

Literature
Course: Numerical Mathematics for Students of Computer Science [T-MATH-102242]

**Responsible:** Prof. Dr. Andreas Rieder  
Dr. Daniel Weiß  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

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

<table>
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**Events**

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<th>Events</th>
<th>Code</th>
<th>Title</th>
<th>Weeks</th>
<th>Type</th>
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</table>
| ST 2024 | 0187400 | Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen | 2 SWS | Lecture  
| Weiß |
| ST 2024 | 0187500 | Übungen zu 0187400 | 1 SWS | Practice  
| Weiß |

**Exams**

<table>
<thead>
<tr>
<th>Exam</th>
<th>Code</th>
<th>Title</th>
<th>Instructor</th>
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<tr>
<td>WT 23/24</td>
<td>6700011</td>
<td>Numerical Mathematics for Students of Computer Science</td>
<td>Wieners</td>
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</tbody>
</table>

**Prerequisites**
None
Course: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

Responsible: Dr. Martin Wörner
Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Recurrence</th>
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<tr>
<td>ST 2024</td>
<td>2130934</td>
<td>Numerical Modeling of Multiphase Flows</td>
<td>2</td>
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Exams

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

Competence Certificate

oral exam 30 minutes

Prerequisites

none

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

Content

1. Introduction in the subject of multi-phase flows (terms and definitions, examples)
2. Physical fundamentals (dimensionless numbers, phenomenology of single bubbles, conditions at fluid interfaces, forces on a suspended particle)
3. Mathematical fundamentals (governing equations, averaging, closure problem)
4. Numerical fundamentals (discretization in space and time, truncation error and numerical diffusion)
5. Models for interpenetrating continua (homogeneous model, algebraic slip model, standard two-fluid model and its extensions)
6. Euler-Lagrange model (particle equation of motion, particle response time, one-/two-/four-way coupling)
7. Interface resolving methods (volume-of-fluid, level-set and front-capturing method)

Organizational issues

Mündliche Prüfung, Dauer: 30 Minuten, Hilfsmittel: keine
Oral examination (in German or English language), Duration: 30 minutes, Auxiliary means: none

Literature

Ein englischsprachiges Kurzskriptum kann unter https://publikationen.bibliothek.kit.edu/270056199 heruntergeladen werden.

Die Powerpoint-Folien werden nach jeder Vorlesung im ILIAS-System zum Herunterladen bereitgestellt.

Eine Liste mit Buchempfehlungen wird in der ersten Vorlesungsstunde ausgegeben.
Course: Numerical Simulation of Turbulent Flows [T-MACH-105397]

Responsible: Dr. Günther Grötzbach
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events

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Exams

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<th>Recurrence</th>
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<td>3 SWS</td>
<td>Lecture / Grötzbach</td>
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</table>

Competence Certificate
oral

Duration: 30 minutes
no auxiliary means

Prerequisites
none

Recommendation
Basics in fluid mechanics

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

Numerical Simulation of Turbulent Flows

2153449, WS 23/24, 3 SWS, Language: German, Open in study portal

Content
The students are qualified to describe the fundamentals of direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent flows. They understand the principle differences between these simulation methods and the respective properties of the conventional turbulence modelling approaches basing on Reynolds Averaged Navier-Stokes equations (RANS). They can describe subgrid scale models, peculiarities of wall and inlet/outlet modelling, suitable numerical solution schemes and evaluation methods. They have obtained the knowledge and understanding required to identify the best modelling approach (among the available methods) for the problem at hand, thus being able to solve given thermal and fluid dynamical problems appropriately.

The lecture series will introduce in following subjects of the turbulence simulation method:

- Appearance of turbulence and deduction of requirements and limits of the simulation method.
- Conservation equations for flows with heat transfer, filtering them in time or space.
- Some subgrid scale models for small scale turbulence and their physical justification.
- Peculiarities in applying boundary and initial conditions.
- Suitable numerical schemes for integration in space and time.
- Statistical and graphical methods to analyse the simulation results.
- Application examples for turbulence simulations in research and engineering

Organizational issues
Dauer der Vorlesung 3 h von 14:00 - 15:30 h und von 15:45 - 16:30 h./Duration of the lecture 3 h from 14:00 - 15:30 h and from 15:45 - 16:30 h.
Literature
G. Grötzbach, Script in English
3.283 Course: Organ Support Systems [T-MACH-105228]

Responsible: apl. Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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Events

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<th>Module Name</th>
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<td>2106008</td>
<td>Organ support systems</td>
<td>2 SWS</td>
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Exams

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<th>Lecturer</th>
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</table>

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

Competence Certificate

Written examination (Duration: 45min)

Prerequisites

none

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

V Organ support systems

2106008, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site

Content

Content:

- Introduction: Definitions and classification of organ support and replacement.
- Special topics: acoustic and visual prostheses, exoskeletons, neuroprostheses, tissue-engineering, hemodialysis, heart-lung machine, artificial hearts, biomaterials.

Learning objectives:

Students have fundamental knowledge about functionality of organ support systems and its components. An analysis of historical developments can be done and limitations of current systems can be found. The limits and possibilities of transplantations can be elaborated.

Organizational issues

Die Vorlesung findet in Präsenz statt.

Literature

- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

Responsible: Patric Werner
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the KIT Department of Informatics

<table>
<thead>
<tr>
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Events

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<td>WT 23/24</td>
<td>7500006</td>
<td>Patent Law</td>
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<td>ST 2024</td>
<td>7500109</td>
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Legend: 🖥 Online, 🎯 Blended (On-Site/Online), 🗣 On-Site, ❎ Cancelled
### 3.285 Course: Phase Transformations in Materials [T-MACH-111391]

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

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

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<td>Lecture / 🗣</td>
<td>3 SWS</td>
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<td>Kauffmann, Heilmaier, Sen</td>
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**Exams**

<table>
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<td>Lecture / 🗣</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam (about 25 min.)

**Prerequisites**

none

**Recommendation**

Materials Science and Engineering I/II and some additional fundamentals on thermodynamics and diffusion or Materials Physics and Metals

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

**Phase Transformations in Materials**

2173421, WS 23/24, 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

**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 from:

https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X

https://doi.org/10.1016/0079-6425(85)90004-0 [currently not available from KIT network but maybe accessed by LEA]

https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC518051110 [free online access from within KIT network]

https://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC030295610

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

https://www.ifw-dresden.de/institutes/imw/events/lectures/lecture-notes/physikalische-werkstoffeigenschaften/ [public domain]
### 3.286 Course: Photovoltaics [T-ETIT-101939]

**Responsible:** Prof. Dr.-Ing. Michael Powalla  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
<thead>
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<th>Credits</th>
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<td>Each summer term</td>
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<th>Description</th>
<th>Credit(s)</th>
<th>Type</th>
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<td>Photovoltaics</td>
<td>3 SWS</td>
<td>Lecture / 🗣</td>
<td>Powalla, Lemmer</td>
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<tr>
<td>ST 2024</td>
<td>2313738</td>
<td>Tutorial 2313737 Photovoltaik</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
<td>Powalla, Lemmer</td>
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**Exams**

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<td>Powalla, Lemmer</td>
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</tr>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**

"M-ETIT-100524 - Solar Energy" must not have started.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-ETIT-100774 - Solar Energy must not have been started.

**Responsible:** apl. Prof. Dr. Ron Dagan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
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<th>Credits</th>
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<td>Each winter term</td>
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#### Events

<table>
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<th>Content</th>
<th>Credits</th>
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<tr>
<td>WT 23/24</td>
<td>2189906</td>
<td>Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle</td>
<td>2 SWS</td>
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#### Exams

<table>
<thead>
<tr>
<th>Events</th>
<th>Code</th>
<th>Content</th>
<th>Examinator</th>
</tr>
</thead>
</table>

**Legend:** 🖥 Online, ☔ Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**  
oral exam, approx. 30 min.

**Prerequisites**  
none

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

**V Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle**  
2189906, WS 23/24, 2 SWS, Language: German, Open in study portal

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

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

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h
self study 46 h
oral exam about 20 min.

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature

AEA öffentliche Dokumentation zu den nuklearen Ereignissen
K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966
J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley $ Sons, Inc. 1975 (in Englisch)
# 3.288 Course: Physical Basics of Laser Technology [T-MACH-102102]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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## Events

<table>
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<tbody>
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<td>2181612</td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🕰 Blended (On-Site/Online), 📌 On-Site, ☑ Cancelled

### Competence Certificate

oral examination (30 min)

- no tools or reference materials

### Prerequisites

It is not possible, to combine this brick with brick Laser Material Processing [T-MACH-112763], brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

### Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.
2. The course T-MACH-112763 - Laser Material Processing must not have been started.

### Recommendation

Basic knowledge of physics, chemistry and material science

### Below you will find excerpts from events related to this course:

**Physical basics of laser technology**

<table>
<thead>
<tr>
<th>Code</th>
<th>SWS</th>
<th>Language: German, Open in study portal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2181612</td>
<td>3</td>
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</tbody>
</table>
Content
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- safety aspects

The lecture is complemented by a tutorial.

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

- regular attendance: 33.5 hours
- self-study: 116.5 hours

The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

Organizational issues
Termine für die Übung werden in der Vorlesung bekannt gegeben!

Literature
T. Graf: Laser - Grundlagen der Laserstrahlerzeugung 2015, Springer Vieweg
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
### 3.289 Course: Physical Measurement Technology [T-MACH-111022]

**Responsible:** Dr. Dominique Buchenau  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
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<td>Each winter term</td>
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<td>76T-MACH-111022</td>
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<td>Physical Measurement Technology</td>
</tr>
</tbody>
</table>

**Competence Certificate**  
Oral exam of about 25 minutes

**Prerequisites**  
none

**Annotation**  
none

Below you will find excerpts from events related to this course:

**Physical Measurement Technology**  
2189490, WS 23/24, 2 SWS, Language: German/English, [Open in study portal](#)

Lecture (V)  
Online
Content

Qualification targets:

Acquisition of knowledge:

- fundamentals of electrical measurement technology
- conversion principles of physical quantities into electrical signals
- conversion and processing of non-electrical quantities
- characteristics and transmission properties of sensors
- basics of analog and digital data acquisition & processing
- fundamentals of optical measurement methods

Skills:

- handling with electrical measuring instruments
- application and handling of simple measurement circuits
- measurement data acquisition and processing, representation of functional dependencies
- analysis of measuring tasks, selection of measuring methods and instruments
- assessment of measurement errors, reduction of systematic errors

Expertise:

- problem analysis and development of suitable solutions
- planning and design of measuring systems
- planning and installation of automated measurement equipment
- assessment of the quality of measurement procedures and results

Structure of Content:

- general introduction
- evaluation of measurement data
- important concepts of measurement techniques
- sensor concepts according to physical effects
- special concepts of physical measurement technology
- D/A and A/D conversion of electrical signals
- digital and analog modulation techniques

Usability:

Suitable for Bachelor program with the following specialisations:

- mechanical engineering
- physical engineering science
- production engineering / Transportation
- information technology in mechanical engineering

The acquired know-how is relevant for all engineering disciplines, especially in the following areas: precision engineering, mechatronics, medical technology, measurement and automation technology etc.

Work input:

Total extent approx. 120 h / thereof 30 h in classroom lecture and exercise

Examination:

The lecture will be concluded by an oral exam of about 25 minutes.

Organizational issues

Anmeldung erforderlich unter il-sekretariat@inr.kit.edu

Literature

- Hecht, E., Optik, Oldenbourg-Verlag, 2005, ISBN 3-486-27359-0
### 3.290 Course: Plastic Electronics / Polymerelectronics [T-ETIT-100763]

**Responsible:** Prof. Dr. Ulrich Lemmer  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
<thead>
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<td>Each winter term</td>
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#### Events

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<td>2313709</td>
<td>2 SWS</td>
<td>Lecture / 🧩</td>
<td>Hernandez Sosa</td>
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#### Exams

<table>
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<th>Credits</th>
<th>Module</th>
<th>Type</th>
<th>Responsible</th>
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</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>7313709</td>
<td>Plastic Electronics / Polymerelectronics</td>
<td></td>
<td>Lemmer, Hernandez Sosa</td>
</tr>
</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑️ Cancelled

### Competence Certificate

The control of success takes place within the framework of an oral overall examination (approx. 30 minutes).

### Prerequisites

none

### Recommendation

Knowledge of semiconductor devices

### Annotation

Lecture and examination are held in German or English, as required.
3.291 Course: Plasticity of Metals and Intermetallics [T-MACH-110818]

 Responsible: Prof. Dr.-Ing. Martin Heilmaier
                Dr.-Ing. Alexander Kauffmann
 Organisation: KIT Department of Mechanical Engineering

 Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<tr>
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<td>Each summer term</td>
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Events

| ST 2024 | 2173648 | Plasticity of Metals and Intermetallics | 4 SWS | Lecture /口中 | Kauffmann, Heilmaier |

Exams

| WT 23/24 | 76-T-MACH-110818 | Plasticity of Metals and Intermetallics | Kauffmann, Heilmaier |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
oral exam (about 25 minutes)

Prerequisites
T-MACH-110268 – Plastizität von metallischen und intermetallischen Werkstoffen has not been started
T-MACH-105301 - Werkstoffkunde III has not been started

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105301 - Materials Science and Engineering III must not have been started.

Below you will find excerpts from events related to this course:

V Plasticity of Metals and Intermetallics
2173648, SS 2024, 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 Patternning)
    ◦ 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:

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)

http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656

https://www.ifw-dresden.de/de/ifw-institutes/ikm/lectures/vorlesungsskript-physikalische-werkstoffeigenschaften (public domain)


### 3.292 Course: Polymer Engineering I [T-MACH-102137]

**Responsible:** Dr.-Ing. Wilfried Liebig  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Type</th>
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<th>Grading scale</th>
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<td>Oral exam</td>
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<td>Grade to a third</td>
<td>Each winter term</td>
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<tr>
<td>WT 23/24</td>
<td>76-T-MACH-102137</td>
<td>Polymer Engineering I</td>
<td>Liebig</td>
<td></td>
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</tbody>
</table>

**Competence Certificate**  
Oral exam, about 25 minutes

**Prerequisites**  
none

**Below you will find excerpts from events related to this course:**

**V**  
Polymer Engineering I  
2173590, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)  

**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.
3.293 Course: Polymer Engineering II [T-MACH-102138]

**Responsible:** Dr.-Ing. Wilfried Liebig  
**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>ST 2024</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
<td>Each summer term</td>
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<tr>
<td>Exams</td>
<td>4</td>
<td>Grade to a third</td>
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</table>

**Prerequisites**

none

**Recommendation**

Knowledge in Polymerengineering I

**Competence Certificate**

Oral exam, about 25 minutes

**Below you will find excerpts from events related to this course:**

### 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.
Course: Polymers in MEMS A: Chemistry, Synthesis and Applications [T-MACH-102192]

Responsible: Dr.-Ing. Bastian Rapp
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</tbody>
</table>

Events

| WT 23/24 | 2141853 | Polymers in MEMS A: Chemistry, Synthesis and Applications | 2 SWS | /🧩 | Worgull |

Exams

| WT 23/24 | 76-T-MACH-102192 | Polymers in MEMS A: Chemistry, Synthesis and Applications | Rapp, Worgull |

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

Polymers in MEMS A: Chemistry, Synthesis and Applications
2141853, WS 23/24, 2 SWS, Language: German, Open in study portal

Organizational issues
Findet als Blockveranstaltung am Semesterende statt.
3.295 Course: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

Responsible: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

Events

| WT 23/24 | 2141854 | Polymers in MEMS B: Physics, Microstructuring and Applications | 2 SWS | Lecture / 🧩 | Worgull |

Exams

| WT 23/24 | 76-T-MACH-102191 | Polymers in MEMS B: Physics, Microstructuring and Applications | Worgull |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

Polymers in MEMS B: Physics, Microstructuring and Applications
2141854, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V) Blended (On-Site/Online)
Polymers in MEMS C - Biopolymers and Bioplastics

Status

Module Handbook as of 23/02/2024

Below you will find excerpts from events related to this course:

Polymers in MEMS C - Biopolymers and Bioplastics
2142855, SS 2024, 2 SWS, Language: German, Open in study portal

Blended (On-Site/Online)

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.

This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.

Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are "natural glues" and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.
Organizational issues
Für weitere Rückfragen, wenden Sie sich bitte an PD Dr.-Ing.- Matthias Worgull (matthias.worgull@kit.edu). Eine Voranmeldung ist nicht notwendig.

Literature
Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.
3.297 Course: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

Responsible: Prof. Dr.-Ing. Albert Albers
               Prof. Dr.-Ing. Sven Matthiesen
               Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Each winter term</td>
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Events

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<td>2 SWS</td>
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<td>Albers, Düser, Ott</td>
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<td>Albers, Ott</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ⏹️ Cancelled

Competence Certificate

written examination: 60 min duration

Prerequisites

None

Below you will find excerpts from events related to this course:

Content

Students acquire the basic skills needed to develop future energy-efficient and safe drive system solutions for use in industrial environments. The course considers holistic development methods and evaluations of drive systems. The focal points can be divided into the following chapters:

- Powertrain System
- Operator System
- Environment System
- System Components
- Development Process

Recommendations:

- Powertrain Systems Technology A: Automotive Systems

Literature

VDI-2241: "Schaltbare fremdbetätigte Reibkupplungen und -bremsen", VDI Verlag GmbH, Düsseldorf
**3.298 Course: Practical Course Combustion Technology [T-CIWVT-108873]**

**Responsible:** Dr.-Ing. Stefan Raphael Harth  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-MACH-105100 - Courses of the KIT Department of Chemical and Process Engineering

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<td>Each summer term</td>
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**Events**

| ST 2024 | 2232060 | Practical Course Combustion Technology | 3 SWS | Practical course / 🗣 | Trimis, Harth |
| ST 2024 | 2232321 | Laboratory Work in Combustion Technology | 3 SWS | Practical course / 🗣 | Harth |

**Exams**

| WT 23/24 | 7231401 | Practical Course Combustion Technology | Harth |
| ST 2024 | 7231401 | Practical Course Combustion Technology | Harth |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO).

**Prerequisites**

None
3.299 Course: Practical Course Technical Ceramics [T-MACH-105178]

**Responsible:** apl. Prof. Dr. Günter Schell  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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**Events**

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<td>Practical course / Schell</td>
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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

**Competence Certificate**

Colloquium and laboratory report for the respective experiments.

**Prerequisites**

none

**Below you will find excerpts from events related to this course:**

**Practical Course Technical Ceramics**  
2125751, WS 23/24, 2 SWS, Language: German, [Open in study portal]

**Organizational issues**

Elektronisch über das ILIAS-Portal

**Literature**


Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006
3.300 Course: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

**Responsible:** Dr. Arndt Last  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment consists of a written exam

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Introduction to Microsystem Technology - Practical Course**

2143875, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**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**

2143877, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**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 2024, 2 SWS, Language: German, [Open in study portal](#)
Content
In the practical training includes ten experiments:
1. Röntgenoptik
2. UVL + REM
3. Mischerbauteil
4. Rasterkraftmikroskopie
5. 3D-Printing
6. Lichtstreuung an Chrommasken
7. Abformung
8. SAW-Biosensorik
9. Nano3D-Drucker - Materialtransfer dünnster Schichten
10. Elektrospinning

Each student takes part in only four experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Organizational issues
Das Praktikum findet in den Laboren des IMT am CN statt. Treffpunkt: Bau 301, vor dem Eingang.
Teilnahmeanfragen an arndt.last@kit.edu

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung 'Grundlagen der Mikrosystemtechnik'
### 3.301 Course: Practical Training in Measurement of Vibrations [T-MACH-105373]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

| ST 2024 | 2162208 | Schwingungstechnisches Praktikum | Practical course / Genda, Fidlin |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🤗 On-Site, ❌ Cancelled

**Competence Certificate**

Colloquium to each session, 10 out of 10 colloquiums must be passed

**Prerequisites**

Can not be combined with Experimental Dynamics (T-MACH-105514).

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105514 - Experimental Dynamics must not have been started.

**Recommendation**

Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations
3.302 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

**Responsible:** apl. Prof. Dr. Günter Schell  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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<td>Basic principles of powder metallurgical and ceramic processing</td>
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**Exams**

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<td>Principles of Ceramic and Powder Metallurgy Processing</td>
<td>Schell</td>
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</table>

**Competence Certificate**
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

**Prerequisites**
none

**Below you will find excerpts from events related to this course:**

**Basic principles of powder metallurgical and ceramic processing**  
2193010, WS 23/24, 2 SWS, Language: German, Open in study portal

**Literature**

- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005  
### 3.303 Course: Principles of Medicine for Engineers [T-MACH-105235]

**Responsible:** apl. Prof. Dr. Christian Pylatiuk  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🚫 Cancelled

**Competence Certificate**

Written examination (Duration: 45min)

**Prerequisites**

none

**Below you will find excerpts from events related to this course:**

### Principles of Medicine for Engineers

2105992, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Content**

**Content:**

- Introduction: Definitions of "health" and "disease". History of medicine and paradigm shift towards evidence based medicine and personalized medicine.
- Special topics: nervous system, saltatory conduction, musculoskeletal system, cardio-circulatory system, narcosis, pain, respiratory system, sensory organs, gynaecology, digestive organs, surgery, nephrology, orthopaedics, immune system, genetics.

**Learning objectives:**

Students have fundamental knowledge about functionality and anatomy of organs within different medical disciplines. The students further know about technical methods in diagnosis and therapy, common diseases, their relevance and costs. Finally the students are able to communicate with medical doctors in a way, in which they prevent misunderstandings and achieve a more realistic idea of each others expectations.

**Literature**

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
### 3.304 Course: Probability Theory and Statistics [T-MATH-109620]

**Responsible:**
- Prof. Dr. Nicole Bäuerle
- Dr. rer. nat. Bruno Ebner
- Prof. Dr. Vicky Fasen-Hartmann
- Prof. Dr. Daniel Hug
- PD Dr. Bernhard Klar
- Prof. Dr. Günter Last
- Prof. Dr. Mathias Trabs
- PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MACH-104885 - Courses of the KIT Department of Mathematics

<table>
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#### Exams

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**Competence Certificate**

Written exam (90 min.)

**Prerequisites**

None
3.305 Course: Process Simulation in Forming Operations [T-MACH-105348]

**Responsible:** Dr.-Ing. Dirk Helm  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Lecture</td>
<td>2 SWS</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📚 On-Site, ☑️ Cancelled

**Competence Certificate**
oral exam, 20 min.

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Process Simulation in Forming Operations**
2161501, WS 23/24, 2 SWS, Language: German, [Open in study portal]

**Lecture (V)**
Blended (On-Site/Online)

**Content**
Based on basics of continuum mechanics, material theory and numerics the lecture gives an introduction into the simulation of forming operations for metals

- plasticity for metallic materials: dislocations, twinning, phase transformations, anistropy, hardening
- classification of forming operations and discussion of selected topics
- basics of tensor algebra and tensor analysis
- continuum mechanics: kinematics, finite deformations, balance laws, thermodynamics
- material theory: basics, modelling concepts, plasticity and visco plasticity, yield functions (von Mises, Hill, ...), kinematic and isotropic hardening, damage
- thermomechanical coupling
- modelling of contact
- finite element method: explicit and implicite formulations, types of elements, numerical integration of material models
- process simulation of selected problems of sheet metal forming

**Organizational issues**
Zeit und Ort: Do, 15:45 - 17:15, Seminarraum 308.1, Geb 10.23
Erste Vorlesung: Do, 02.11.2023, 15:45 - 17:15
3.306 Course: Product and Innovation Management [T-WIWI-109864]

Responsible: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

<table>
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Exams
WT 23/24 7900055 Product and Innovation Management Klarmann

Competence Certificate
The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. Further details will be announced during the lecture.

Prerequisites
None

Annotation
Please note that Product and Innovation Management will not be offered again until summer semester 2026. The course will not take place in the summer semester 2024 and 2025.
For further information, please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Responsible: Dr. Stefan Kienzle  
Dr. Dieter Steegmüller  

Organisation: KIT Department of Mechanical Engineering  

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering  

<table>
<thead>
<tr>
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Events

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<th>2149670</th>
<th>Product- and Production-Concepts for modern Automobiles</th>
<th>2 SWS</th>
<th>Lecture / Blended (On-Site/Online)</th>
<th>Steegmüller, Kienzle</th>
</tr>
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Exams

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<th>76-T-MACH-110318</th>
<th>Product- and Production-Concepts for modern Automobiles</th>
<th>Steegmüller, Kienzle</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗓️ Cancelled

Competence Certificate  
Oral Exam (20 min)

Prerequisites  
T-MACH-105166 - Materials and Processes for Body Lightweight Construction in the Automotive Industry must not have been started.

Below you will find excerpts from events related to this course:

**Product- and Production-Concepts for modern Automobiles**  
2149670, WS 23/24, 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:
Skrift zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).
3 COURSES
Course: Product Development - Dimensioning of Components [T-MACH-105383]

<table>
<thead>
<tr>
<th>3.308 Course: Product Development - Dimensioning of Components [T-MACH-105383]</th>
</tr>
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</table>
| **Responsible:** Dr.-Ing. Stefan Dietrich  
Prof. Dr.-Ing. Volker Schulze |
| **Organisation:** KIT Department of Mechanical Engineering |

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
written exam (2 hours)

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Product Development - Component Dimensioning**

<table>
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**Content**
The aim of the lecture is to present the topics of the dimensioning and the material science in their connection and to learn how to deal with corresponding methods and the combination thereof.  

For the prospective engineer the most important educational objective is to understand the interaction of these topics while the interplay of the individual material stresses in the component are clarified.

The topics in detail are:
- Structural dimensioning: basic stresses, superimposed stresses, notch influence, fatigue limit, fatigue strength, assessment of cracked components, operational strength, residual stresses, high temperature stress and corrosion
- Material selection: Basics, material indices, material selection diagrams, Ashby procedure, multiple boundary conditions, target conflicts, shape and efficiency.
- Learning target: The students... are capable to design and dimension components according to their load.  
- can include mechanical material properties from the mechanical material test in the dimensioning process.  
- can identify superimposed total loads and critical loads on simple components and to compute them.  
- acquire the skill to select materials based on the application area of the components and respective loads.

**Examination:** written exam (2 hours)

**Organizational issues**
Freitags generell nach Vereinbarung

**Literature**
Vorlesungsskript
3.309 Course: Product Lifecycle Management [T-MACH-105147]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Exams**

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Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🗤 On-Site, ✗ Cancelled

**Competence Certificate**

Written examination 90 min.

**Prerequisites**

None

**Below you will find excerpts from events related to this course:**

### Product Lifecycle Management

2121350, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**On-Site**

**Content**

The course includes:

- Basics for product data management and data exchange
- IT system solutions for Product Lifecycle Management (PLM)
- Economic viability analysis and implementation problems
- Illustrative scenario for PLM using the example of the institute's own I4.0Lab

After successful attendance of the course, students can:

- identify the challenges of data management and exchange and describe solution concepts for these challenges.
- clarify the management concept PLM and its goals and highlight the economic benefits.
- explain the processes required to support the product life cycle and describe the most important business software systems (PDM, ERP, ...) and their functions.

**Literature**

Vorlesungsfolien.


3.310 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

**Responsible:** Prof. Dr.-Ing. Sama Mbang

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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</table>

**Competence Certificate**
Oral examination 20 min.

**Prerequisites**
None

**Annotation**
Limited number of participants.

Below you will find excerpts from events related to this course:

**Product, Process and Resource Integration in the Automotive Industry**

V 2123364, SS 2024, 2 SWS, Language: German, Open in study portal

**Content**
- Overview of product development in the automotive sector (process- and work cycle, IT-Systems)
- Integrated product models in the automotive industry (product, process and resource)
- New CAx modeling methods (intelligent feature technology, templates & functional modeling)
- Automation and knowledge-based mechanism for product design and production planning
- Product development in accordance with defined process and requirement (3D-master principle, tolerance models)
- Concurrent Engineering, shared working
- Enhanced concepts: the digital and virtual factory (application of virtual technologies and methods in the product development)

**Organizational issues**
Blockveranstaltung

**Literature**
Vorlesungsfolien
3.311 Course: Production Operations Management [T-MACH-110327]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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Events

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Exams

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<td>Lanza, Furmans</td>
<td></td>
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</tbody>
</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam (duration: 90 min)

Prerequisites
T-MACH-110326 - Production Operations Management-Project must have been completed successfully.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110326 - Production Operations Management-Project must have been passed.

Below you will find excerpts from events related to this course:

Production Operations Management
3118031, WS 23/24, 3 SWS, Language: English, Open in study portal

Content
T-MACH-110326 - Production Operations Management-Project must have been completed successfully when registering for this course.

It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (wbk). The institutes alternate with each cycle.

The lecture covers the basics of operations and supply chain management as well as business management basics in accounting, investment calculation and legal forms.

If you successfully passed this course you will be able to:

- state the relevant technical terms of business administration, logistics and production engineering
- describe the interrelation between these technical terms
- describe the most important decision problems qualitatively and quantitatively
- apply the appropriate decision models to solve the respective decision problems
- critically evaluate the results and draw appropriate conclusions
- extend the learned methods and models by researching on your own

Attendance time: 25 hours,
Self-study: 65 hours

Organizational issues
Räume werden vom Institut bekannt gegeben.
3.312 Course: Production Operations Management-Project [T-MACH-110326]

**Responsible:** Prof. Dr.-Ing. Kai Furmans
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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</table>

**Legend:** 🔶 Online, 🔄 Blended (On-Site/Online), 📖 On-Site, ❌ Cancelled

**Competence Certificate**
For solving four case studies as a group work, a maximum of 100 points per case study and student will be awarded. The defense of the case studies will be assessed as an individual contribution with a maximum of 100 points. The maximum score of 500 points corresponds to a grade of 1.0. A detailed evaluation scheme will be provided to the students during the course.

**Prerequisites**
none

**Below you will find excerpts from events related to this course:**

**Production Operations Management-Project**
3118032, WS 23/24, 1 SWS, Language: English, [Open in study portal]

**Project (PRO)**
Blended (On-Site/Online)

**Content**
Students are divided into groups for this course. Four case studies will be carried out in these groups. The results of the group work will be presented and evaluated in writing. Prerequisite for the participation in the case study is the previous successful participation in a multiple choice test, which can be repeated online several times in a given period. The result of the group work is presented and evaluated in writing. In addition, selected groups will present and defend their results.

After successful completion of the lecture you will be able to work alone and in a team

- to **name** the treated **technical terms** in the areas of production, logistics and business administration,
- to **accurately describe** the connections between these areas in a discussion with experts,
- to **describe qualitatively and quantitatively** the most important decision-making problems in this field,
- to use the corresponding qualitative and quantitative decision models,
- to critically **evaluate** their results and draw conclusions from them,
- as well as to expand the methods and models discussed through **own research**.

The participation of all members of the selected groups in the oral defenses is compulsory and will be controlled. Four written submissions must be passed. For the written submission the group receives a common grade, in the defense each group member is evaluated individually. The defenses are fully included in the grade, but they do not have to be passed in order to pass the entire event. The final score of the event consists of 80% of the written submissions and 20% of the defense evaluation.

It is a joint lecture of the Institute of Materials Handling and Logistics (IFL) and the Institute of Production Science (wbk). The institutes alternate with each cycle.

**Attendance time:** 17 hours,

**Self-study:** 43 hours

**Organizational issues**
Räume werden vom Institut bekannt gegeben.
3.313 Course: Production Planning and Control [T-MACH-105470]

**Responsible:** Dr.-Ing. Andreas Rinn  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Each winter term</td>
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**Competence Certificate**  
written exam 60 minutes (if the number of participants is low, the examination is oral, 20 minutes)

**Prerequisites**  
Timely pre-registration in ILIAS, since participation is limited.
3.314 Course: Production Techniques Laboratory [T-MACH-105346]

**Responsible:** Prof. Dr.-Ing. Barbara Deml  
Prof. Dr.-Ing. Jürgen Fleischer  
Prof. Dr.-Ing. Kai Furmans  
Prof. Dr.-Ing. Jivka Ovtcharova

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>Each summer term</td>
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**Events**

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<th>4 SWS</th>
<th>Practical course / 🧩</th>
<th>Deml, Fleischer, Furmans, Meyer</th>
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</table>

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⬇️ Cancelled

**Competence Certificate**

**Advanced Internship:** Participate in practical exercise courses and complete the colloquia successfully.

**Elective Subject:** Participate in practical exercise courses and complete the colloquia successfully and presentation of a specific topic.

**Prerequisites**

The course is limited in capacity, therefore the allocation of places is based on § 5 (4) in the Study and Examination Regulations. This results in the following selection criteria:

The selection is based on:

- on the study progress (here the study progress in credit points and not the study progress in semesters is taken as a basis),
- on the waiting period in the case of equal progress in studies
- by lot if the waiting period is the same.

The procedure is explained in more detail on ILIAS.

Successful participation requires active and continuous participation in the course.

*Below you will find excerpts from events related to this course:*
Content
The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Information management for I4.0 (IMI)  
2. VR-supported product development (IMI)  
3. Production of parts with CNC turning machines (wbk)  
4. Controlling of production systems using PLCs (wbk)  
5. Automated assembly systems (wbk)  
6. Flexible material flow in the age of Industry 4.0 (IFL)  
7. Identification in production and logistics (IFL)  
8. Storage and order-picking systems (IFL)  
9. Production Management (ifab)  
10. Time study (ifab)  
11. Accomplishment of workplace design (ifab)

Recommendations:
Participation in the following lectures:
- Informationssystems in logistics and supply chain management
- Material flow in logistic systems
- Manufacturing technology
- Human Factors Engineering

Learning Objects:
The students acquire in the lab profound knowledge about the scientific theories, principles and methods of Production Engineering. Afterwards they are able to evaluate and design complex production systems according to problems of manufacturing and process technologies, materials handling, handling techniques, information engineering as well as production organisation and management.

After completion this lab, the students are able
- to analyse and solve planning and layout problems of the discussed fields,
- to evaluate and configure the quality and efficiency of production, processes and products,
- to plan, control and evaluate the production of a production enterprise,
- to configure and evaluate the IT architecture of a production enterprise,
- to design and evaluate appropriate techniques for conveying, handling and picking within a production system,
- to design and evaluate the part production and the assembly by considering the work processes and the work places.

Organizational issues
Anwesenheitspflicht, Teilnehmerzahl begrenzt. Anmeldung über ILIAS

Arbeitsaufwand von 120 h (=4 LP).

Nachweis: bestanden / nicht bestanden

Regelmäßige Teilnahme an Praktikumsversuchen und erfolgreiche Eingangskolloquien.

Zur Vertiefung des im Rahmen der Lehrveranstaltung erworbenen Wissens werden die theoretischen Vorlesungseinheiten durch Praxiserfahrungen 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
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.
3.315 Course: Productivity Management in Production Systems [T-MACH-105523]

**Responsible:** Prof. Dr.-Ing. Sascha Stowasser  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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<td>Stowasser</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam (approx. 30 min)
The exam is offered in German only!

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Productivity Management in Production Systems**
2110046, SS 2024, 2 SWS, Language: German, [Open in study portal](#) On-Site

**Content**

1. Definition and terminology of process design and industrial engineering  
2. Tasks of industrial engineering  
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)  
4. Methods and principles of industrial engineering and production systems  
5. Case studies and exercises for process design  
6. Industry 4.0

**Requirements:**

- Compact course (one week full-time)  
- Limited number of participants; seats are assigned according the date of registration  
- Registration via ILIAS is required  
- Compulsory attendance during the whole lecture

**Recommendations:**

- Knowledge of work science is helpful

**Learning objective:**

- Ability to design work operations and processes effectively and efficiently  
- Instruction in methods of time study (MTM, Data acquisition etc.)  
- Instruction in methods and principles of process design  
- The Students are able to apply methods for the design of workplaces, work operations and processes.  
- The Students are able to apply actual approaches of process and production organisation.

**Literature**
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.
### 3.316 Course: Project Report Water Distribution Systems [T-BGU-108485]

**Responsible:** Dr.-Ing. Peter Oberle  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

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**Events**

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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌠ Cancelled

**Competence Certificate**

project report, appr. 15 pages, and presentation, appr. 15 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
3.317 Course: Project work [T-MACH-110106]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104840 - Project

Type
Final Thesis
Credits
20
Grading scale
Grade to a third
Recurrence
Each term
Version
1

Competence Certificate
The Project work work consists of a written report of a scientific subject chosen by the student himself/herself or given by the supervisor. The Project work is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

Prerequisites
none

Final Thesis
This course represents a final thesis. The following periods have been supplied:

<table>
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<th>Duration</th>
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<td>Maximum extension period</td>
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<td>Correction period</td>
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</table>
Below you will find excerpts from events related to this course:

## Project Workshop: Automotive Engineering

### Content

During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

### Learning Objectives:

During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.
Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, in deutscher Sprache. Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.
Termin und Raum: siehe Institutshomepage.
Limited number of participants with selection procedure, in German language. Please send the application at the end of the previous semester.
Date and room: see homepage of institute.

Literature

Skripte werden beim Start-up Meeting ausgegeben.
The scripts will be supplied in the start-up meeting.

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Learning Objectives:
The students are familiar with typical industrial development processes and working style. They are able to apply knowledge gained at the university to a practical task. They are able to analyze and to judge complex relations. They are ready to work self-dependently, to apply different development methods and to work on approaches to solve a problem, to develop practice-oriented products or processes.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, die Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.
Raum und Termine: s. Aushang bzw. Homepage

Literature

Skripte werden beim Start-up Meeting ausgegeben.
3.319 Course: Python Algorithm for Vehicle Technology [T-MACH-110796]

Responsible: Stephan Rhode

Organisation: Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Each summer term</td>
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Events

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<td>2114862</td>
<td>Python Algorithms for Automotive Engineering</td>
<td>2 SWS, Lecture / X, Rhode</td>
</tr>
</tbody>
</table>

Exams

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Lecture</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>76-T-Mach-110796</td>
<td>Python Algorithm for Vehicle Technology</td>
<td>Rhode</td>
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<tr>
<td>ST 2024</td>
<td>76-T-MACH-110796</td>
<td>Python Algorithm for Vehicle Technology</td>
<td>Rhode</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, ⬿ Blended (On-Site/Online), ⬿ On-Site, ⬿ Cancelled

Compeence Certificate

Written Examination

Duration: 90 minutes

Prerequisites

none

Below you will find excerpts from events related to this course:

Python Algorithms for Automotive Engineering

2114862, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V) Cancelled

Content

Teaching content:

- Introduction to Python and useful tools and libraries for creating algorithms, graphical representation, optimization, symbolic arithmetic and machine learning
  - Anaconda, Pycharm, Jupyter
  - NumPy, Matplotlib, SymPy, Scikit-Learn
- Methods and tools for creating software
  - Version management GitHub, git
  - Testing software pytest, Pylint
  - Documentation Sphinx
  - Continuous Integration (CI) Travis CI
  - Workflows in Open Source and Inner Source, Kanban, Scrum
- Practical programming projects to:
  - Road sign recognition
  - Vehicle state estimation
  - Calibration of vehicle models by mathematical optimization
  - Data-based modelling of the powertrain of an electric vehicle

Objectives:

The students have an overview of the programming language Python and important Python libraries to solve automotive engineering problems with computer programs. The students know current tools around Python to create algorithms, to apply them and to interpret and visualize their results. Furthermore, the students know basics in the creation of software to be used in later programming projects in order to develop high-quality software solutions in teamwork. Through practical programming projects (road sign recognition, vehicle state estimation, calibration, data-based modelling), the students can perform future complex tasks from the area of driver assistance systems.

Organizational issues

Die Vorlesung wird im erst wieder im Sommersemester 2025 stattfinden.
Literature

3.320 Course: Quality Management [T-MACH-102107]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Written exam</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

<table>
<thead>
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<th>Event Code</th>
<th>Type</th>
<th>Credits</th>
<th>Grade</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>Lecture / 🧩 Blended (On-Site/Online)</td>
<td>2 SWS</td>
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<td>WT 23/24</td>
<td>Quality Management</td>
<td>76-T-MACH-102107</td>
<td>Lanza</td>
<td></td>
</tr>
</tbody>
</table>

**Competition Certificate**

Written Exam (60 min)

**Prerequisites**

It is not possible to combine this brick with brick Quality Management [T-MACH-112586].

Below you will find excerpts from events related to this course:

**Quality Management**

2149667, WS 23/24, 2 SWS, Language: German, Open in study portal
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/).
3.321 Course: Rail System Technology [T-MACH-106424]

**Responsible:** Prof. Dr.-Ing. Martin Cichon  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Each term</td>
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**Events**

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<th>Lecture Code</th>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Responsible</th>
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</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>76-T-MACH-106424</td>
<td>2115919</td>
<td>Lecture / On-Site</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>Cichon, Heckele</td>
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<td>ST 2024</td>
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<td>Lecture / On-Site</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each term</td>
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<td>Lecture / On-Site</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>Cichon, Heckele, Reimann</td>
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<td>Rail System Technology</td>
<td>76-T-MACH-106424</td>
<td>Lecture / On-Site</td>
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<td>Grade to a third</td>
<td>Each term</td>
<td>Cichon, Berthold</td>
</tr>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

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

Below you will find excerpts from events related to this course:

**Rail System Technology**

2115919, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)

**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).

**Rail System Technology**

2115919, SS 2024, 2 SWS, Language: German, [Open in study portal](#)
Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
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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
ab SS 2024 schriftliche Prüfung

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.
A bibliography is available for download (Ilias-platform).
3.322 Course: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Martin Cichon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<th>Course Name</th>
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<th>Lecture</th>
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<td>Rail Vehicle Technology</td>
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Exams

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<th>SWS</th>
<th>Responsible</th>
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<tr>
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<td>76-T-MACH-105353</td>
<td>Rail Vehicle Technology</td>
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<td>Cichon, Reimann, Heckele</td>
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<td>ST 2024</td>
<td>76-T-MACH-105353</td>
<td>Rail Vehicle Technology</td>
<td>2</td>
<td>Cichon, Berthold</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔼 On-Site, ✗ Cancelled

Competence Certificate
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

Below you will find excerpts from events related to this course:

**Rail Vehicle Technology**

2115996, WS 23/24, 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

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.
A bibliography is available for download (Ilias-platform).
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
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6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends

Organizational issues
ab SS 2024 schriftliche Prüfung

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.
A bibliography is available for download (Ilias-platform).
### 3.323 Course: Railways in the Transportation Market [T-MACH-105540]

**Responsible:** Prof. Dr.-Ing. Martin Cichon  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<th>Type</th>
<th>Recurrence</th>
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<td>Railways in the Transportation Market</td>
<td>2</td>
<td>Block / On-Site</td>
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**Exams**

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<th>Title</th>
<th>SWS</th>
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<td>Railways in the Transportation Market</td>
<td>2</td>
<td>Block / On-Site</td>
<td>Cichon</td>
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</table>

**Competence Certificate**

- **Oral examination**
- **Duration:** ca. 20 minutes
- No tools or reference materials may be used during the exam.

**Prerequisites**

- None

**Below you will find excerpts from events related to this course:**

#### Railways in the Transportation Market

2114914, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Block (B) On-Site**

**Content**

The lecture gives an overview about perspective, challenges and chances of rail systems in the national and European market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Regulation of railways
- Financing and development of rail infrastructure
- Group strategy “Strong Rail” and their building blocks: (climate, environment, digitalization, “Strong Rail” in Baden-Württemberg)
- Trends in the transportation market
- Field of actions in transport policy
- Intra- and intermodal competition
- Summary

**Learning Objectives:**

- To capture the entrepreneurial perspective on transport companies
- To appraise the intra- and intermodal competition
- To understand the regulative determinant
- To reflect trends in transportation market
- To comprehend strategic challenges, chances and fields of actions of transport companies
- To apply intermodal perspective
- To take important key figures of railways and transportation market
- To realize the relevance of sustainability and digitalization
Organizational issues

Literature
keine
Course: Reactor Safety I: Fundamentals [T-MACH-105405]

**3.324 Course: Reactor Safety I: Fundamentals [T-MACH-105405]**

**Responsible:** Dr. Victor Hugo Sanchez-Espinoza

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<th>Version</th>
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<td>Each summer term</td>
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**Events**

| ST 2024 | 2189465 | Reactor Safety I: Fundamentals | 2 SWS | Lecture / 🗣 | Sanchez-Espinoza, Zhang |

| Exams |
|---|---|---|---|---|
| WT 23/24 | 76-T-MACH-105405 | Reactor Safety I: Fundamentals | | Sanchez-Espinoza |

**Competence Certificate**
oral exam about 30 minutes

**Prerequisites**
none

*Below you will find excerpts from events related to this course:*

**Reactor Safety I: Fundamentals**

2189465, SS 2024, 2 SWS, Language: German/English, [Open in study portal](#)
Content
This lecture will be given in English, if required in German

The lecture discuss the fundamental principles and concepts of reactor safety including the methodologies for safety assessment and major accidents.

In the lecture, the fundamental principles and concepts of reactor safety are discussed. They facilitate the assessment of the safety status of nuclear power plants and the interpretation of incidents or accidents as such as Chernobyl or Fukushima. Starting with the explanations of the technical safety features of reactor systems, the safety concepts of different reactor types are discussed. The initiation and progression of incidents/accidents as well as the methods for the safety evaluation are also treated in the lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Methods for safety analysis and safety assessment
- Key physical phenomena during severe accidents determining radiological impact
- How to analyse reactor accidents with numerical simulation tools
- Discussion severe accidents e.g. the Fukushima accident

Lernziele

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents

Knowledge in energy technology, nuclear power plants, reactor physics, thermal hydraulic of nuclear reactors is welcomed

regular attendance: 30 h
self-study: 60 h

Zielgruppe: Students of Mechanical Engineering,
oral examination, duration approximately 30 minutes

Organizational issues
Mündliche Prüfung (Oral examination)
Anmeldung im ILIAS (Registration through ILIAS)

Literature

- A. Ziegler, Lehrbuch der Reaktortechnik Band 1 und 2, Springer Verlag, 1986
- D. Smidt, Reaktorsicherheitstechnik. Springer-Verlag Berlin Heidelberg New York. 1979
- D. Smidt, Reaktortechnik, Band 2, Verlag G. Braun, Karlsruhe, 1976
3.325 Course: Reduction Methods for the Modeling and the Simulation of Combustion Processes [T-MACH-105421]

**Responsible:** Dr. Viatcheslav Bykov  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

<table>
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<th>Code</th>
<th>Lectures</th>
<th>Description</th>
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<tr>
<td>ST 2024</td>
<td>2166543</td>
<td>Lecture</td>
<td>Reduction methods for the modeling and the simulation of combustion processes</td>
<td>Lecture (V)</td>
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</table>

**Competence Certificate**  
Oral exam, approx. 20 min

**Prerequisites**  
none

*Below you will find excerpts from events related to this course:*

**Reduction methods for the modeling and the simulation of combustion processes**  
2166543, SS 2024, 2 SWS, Language: German/English, Open in study portal

**Content**  
The course will introduce the principles of model reduction of chemical kinetic models of combustion processes. The basic mathematical concepts and methods of analysis of chemical reaction mechanisms will be outlined in the context of model reduction. The detailed implementation scheme of model reduction will be introduced. The course will cover simplified and idealized models of combustion (e.g. auto-ignition, explosion, deflagration etc.), which will be analyzed and reduced. The main analytical methods and numerical tools will be presented, evaluated and illustrated by using these simple examples.

**Organizational issues**  
Termin: Mi, 14:00-15:30. Für Änderungen siehe Aushang im ITT-Schaukasten und auf der Internetseite des Instituts.

**Literature**  
3.326 Course: Reliability Engineering 1 [T-MACH-107447]

**Responsible:** Dr.-Ing. Alexei Konnov

**Organisation:** KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Each winter term</td>
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**Competence Certificate**
written exam

**Prerequisites**
none

Responsible: PD Dr. Patrick Jochem
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the KIT Department of Economics and Management

Type: Written examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 7

Events

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Exams

<table>
<thead>
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<td>7</td>
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</table>

Competence Certificate
The assessment consists of a written exam (60 minutes, in English, answers are possible in German or English) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites
None.

Below you will find excerpts from events related to this course:

V Renewable Energy – Resources, Technologies and Economics
2581012, WS 23/24, 2 SWS, Language: English, Open in study portal
Lecture (V) On-Site

Content
1. General introduction: Motivation, Global situation
2. Basics of renewable energies: Energy balance of the earth, potential definition
3. Hydro
4. Wind
5. Solar
6. Biomass
7. Geothermal
8. Other renewable energies
9. Promotion of renewable energies
10. Interactions in systemic context
11. Excursion to the "Energieberg" in Mühlburg

Learning Goals:
The student

- understands the motivation and the global context of renewable energy resources,
- gains detailed knowledge about the different renewable resources and technologies as well as their potentials,
- understands the systemic context and interactions resulting from the increased share of renewable power generation,
- understands the important economic aspects of renewable energies, including electricity generation costs, political promotion and marketing of renewable electricity,
- is able to characterize and where required calculate these technologies.

Organizational issues
Blockveranstaltung, freitags 14:00-17:00 Uhr, 27.10., 10.11., 24.11., 08.12., 19.01., 26.01., 09.02.
Literature
Weiterführende Literatur:

3.328 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

<table>
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**Events**

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**Exams**

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<td>7500218</td>
<td>Robotik I - Einführung in die Robotik</td>
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</table>

**Competence Certificate**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

none.
3.329 Course: Robotics II - Humanoid Robotics [T-INFO-105723]

**Responsible:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

<table>
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**Events**

| ST 2024 | 2400074 | Robotics II: Humanoid Robotics | 2 SWS | Lecture / 🗣 | Asfour |

**Exams**

| WT 23/24 | 7500211 | Robotics II: Humanoid Robotics | Asfour |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☢ Cancelled

**Competence Certificate**
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Recommendation**
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

Below you will find excerpts from events related to this course:

**Robotics II: Humanoid Robotics**

2400074, SS 2024, 2 SWS, Language: English, Open in study portal

**Content**
The lecture presents current work in the field of humanoid robotics that deals with the implementation of complex sensorimotor and cognitive abilities. In the individual topics different methods and algorithms, their advantages and disadvantages, as well as the current state of research are discussed.

The topics addressed are: Applications and real world examples of humanoid robots; biomechanical models of the human body, biologically inspired and data-driven methods of grasping, imitation learning and programming by demonstration; semantic representations of sensorimotor experience as well as cognitive software architectures of humanoid robots.

**Learning Objectives:**
The students have an overview of current research topics in autonomous learning robot systems using the example of humanoid robotics. They are able to classify and evaluate current developments in the field of cognitive humanoid robotics.

The students know the essential problems of humanoid robotics and are able to develop solutions on the basis of existing research.

**Organizational issues**
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.  
Arbeitsaufwand: 90 h  
Empfehlungen: Der Besuch der Vorlesungen Robotik I – Einführung in die Robotik und Mechano-Informatik in der Robotik wird empfohlen  
Zielgruppe: Modul für Master Informatik, Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik

**Literature**
Weiterführende Literatur
Wissenschaftliche Veröffentlichungen zum Thema, werden auf der VL-Website bereitgestellt.

**Responsible:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-104883 - Courses of the KIT Department of Informatics

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**Events**

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**Exams**

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Legend: 🖥 Online, 🇨🇳 Blended (On-Site/Online), 🗣 On-Site, ✖ Cancelled

**Competence Certificate**
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**
none.

**Recommendation**
Attending the lecture Robotics I – Introduction to Robotics is recommended.

**Below you will find excerpts from events related to this course:**

**Robotics III - Sensors and Perception in Robotics**

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**Lecture (V) On-Site**

**Content**
The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, semantic scene interpretation and (inter-)active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state ( proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization, semantic scene interpretation and (inter-)active perception.

**Learning Objectives:**
Students know the main sensor principles used in robotics and understand the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and environmental modeling.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

**Organizational issues**
Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

**Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik**

Empfehlungen: Der Besuch der Vorlesung Robotik I – Einführung in die Robotik wird empfohlen

Zielgruppe: Die Vorlesung richtet sich an Studierende der Informatik, der Elektrotechnik und des Maschinenbaus sowie an alle Interessenten an der Robotik.

Arbeitsaufwand: 90 h

**Literature**
Eine Foliensammlung wird im Laufe der Vorlesung angeboten.

Begleitende Literatur wird zu den einzelnen Themen in der Vorlesung bekannt gegeben.
### 3.331 Course: Safety Engineering [T-MACH-105171]

**Responsible:** Hans-Peter Kany  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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#### Events

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**Legend:**  
🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, 🗑️ Cancelled

#### Competence Certificate

The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

#### Prerequisites

none

**Below you will find excerpts from events related to this course:**

#### Safety Engineering

**2117061, WS 23/24, 2 SWS, Language: German, Open in study portal**

**Lecture (V) On-Site**

#### Content

**Media**

Presentations

**Learning content**

The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

**Learning goals**

The students are able to:

- Name and describe relevant safety concepts of safety engineering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and European safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

#### Recommendations

None

**Workload**

Regular attendance: 21 hours  
Self-study: 99 hours

**Organizational issues**

Termine: siehe ILIAS.

**Literature**

Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und Verlag: H. von Ameln, Ratingen
**3.332 Course: Scaling in Fluid Dynamics [T-MACH-105400]**

**Responsible:** apl. Prof. Dr. Leo Bühler  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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**Competence Certificate**

Oral exam  
Duration: 20-30 minutes  
No auxiliary means

**Prerequisites**

none

**Recommendation**

Fluid Mechanics (T-MACH-105207)

**Below you will find excerpts from events related to this course:**

**Scaling in fluid dynamics**

2154044, SS 2024, 2 SWS, Language: German, Open in study portal

**Content**

- Introduction  
- Similarity rules (examples)  
- Dimensional analysis (Pi-theorem)  
- Scaling in differential equations  
- Scaling in boundary layers  
- Self-similar solutions  
- Scaling in turbulent shear layers  
- Rotating flows  
- Magnetohydrodynamic flows

**Educational objective:** The student can extract non-dimensional number from the characteristic properties of flows. From the insights on scaling laws, the students are qualified to identify the influencing quantities from generic experiments and transfer these to real applications. The students can simplify the governing equations of fluid mechanic appropriately and can interpret the achieved results as a basis for efficient solution strategies.

**Literature**

- J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun  
3.333 Course: Selected Chapters of the Combustion Fundamentals [T-MACH-105428]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
Oral exam, approx. 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Selected chapters of the combustion fundamentals
2167541, WS 23/24, 2 SWS, Language: German, Open in study portal

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Organizational issues
Nach Vereinbarung, siehe Aushang.

Literature
Vorlesungsunterlagen

V Selected chapters of the combustion fundamentals
2167541, SS 2024, 2 SWS, Language: German, Open in study portal

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Organizational issues
Blockveranstaltung. Termine siehe Schaukasten und Internetseite des Instituts.

Literature
Vorlesungsunterlagen
3.34 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Events

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Exams

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<td>Dagan, Metz</td>
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Legend: 🖥 Online, 🛠 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

Competence Certificate

oral exam, approx. 1/2 hour

Prerequisites

none

Below you will find excerpts from events related to this course:

Selected Problems of Applied Reactor Physics and Exercises

2190411, SS 2024, 2 SWS, Language: German/English, Open in study portal

Lecture (V) On-Site

Content

- Nuclear energy and forces
- Radioactive decay
- Nuclear processes
- Fission and the importance of delayed neutrons
- Basics of nuclear cross sections
- Principles of chain reaction
- Static theory of mono energetic reactors
- Introduction to reactor kinetic
- student laboratory

The students

- have solid understanding of the basic reactor physics
- are able to estimate processes of growth and decay of radionuclides; out of it, they can perform dose calculation and introduce their biological hazards
- can calculate the relationship of basic parameters which are needed for a stable reactor operation
- understand important dynamical processes of nuclear reactors.

Regular attendance: 26 h
self study 94 h
oral exam about 30 min.

Literature

K. Wirtz Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966
J. Duderstadt and L. Hamilton, Nuclear reactor Analysis, J. Wiley & Sons, Inc. 1975 (in English)
3.335 Course: Self-Booking-MSc-HOC-SPZ-ZAK-Graded [T-MACH-111687]

**Responsible:** Prof. Dr.-Ing. Martin Heilmann

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106255 - Key Competences

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**Competence Certificate**
Completed coursework

**Prerequisites**
None

**Self service assignment of supplementary studies**
This course can be used for self service assignment of grade acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale

**Annotation**
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".
### 3.336 Course: Self-Booking-MSc-HOC-SPZ-ZAK-Non-Graded [T-MACH-111686]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106255 - Key Competences

<table>
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<td>Each term</td>
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**Competence Certificate**  
Completed coursework

**Prerequisites**  
None

**Self service assignment of supplementary studies**  
This course can be used for self service assignment of grade acquired from the following study providers:

- House of Competence  
- Sprachenzentrum  
- Zentrum für Angewandte Kulturwissenschaften und Studium Generale

**Annotation**  
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".
## Course: Seminar in Materials Science [T-MACH-100290]

### Responsible
Dr. Patric Gruber  
Dr. rer. nat. Stefan Wagner

### Organisation
KIT Department of Mechanical Engineering

### Part of
M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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### Events
| ST 2024 | 2178450 | Seminar in Materials Science | 2 SWS | Seminar / On-Site | Gruber, Wagner |

Legend: 🖥 Online, 📦 Blended (On-Site/Online), ⚜️ On-Site, ✗ Cancelled

### Competence Certificate
- Attendance on all seminars
- Preparation of an oral talk (meeting with mentor)
- Presentation of oral talk

### Prerequisites
Materials Physics, Metals, basics in Ceramics

### Below you will find excerpts from events related to this course:

#### Seminar in Materials Science
2178450, SS 2024, 2 SWS, Language: German, Open in study portal

#### Content
Topics in materials science within the framework of the lectures Materials Physics, Metals and Introduction to Ceramics.  
The students are able to work target- and resources-oriented on a scientific case in the field of material science under specified conditions. They are able to research and select scientifical and technical informations according to set criteria. The students are able to prepare and present the scientific case in a clear and convincing manner in an oral presentation.

#### Literature
Themenspezifisch

**Responsible:** Prof. Dr. Bryce Sydney Richards  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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**Events**

| ST 2024 | 2313761 | Seminar Novel Concepts for Solar Energy Harvesting | 2 SWS | Seminar / 🗣 Paetzold |

Legend: 🖥 Online, ⚡ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The examination consists of a written journal article and an oral presentation of the student's work, both given in English. The overall impression is rated.

**Prerequisites**

none
3.339 Course: Sensors [T-ETIT-101911]

**Responsible:** Dr. Wolfgang Menesklou  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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<td>Menesklou</td>
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### Course: Simulation of Coupled Systems [T-MACH-105172]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<th>Lecture / 🗣</th>
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**Exams**

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**Competence Certificate**

The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at very ordinary examination date.

A registration is mandatory, the details will be announced on the webpages of the Institute of Vehicle System Technology / Institute of Mobile Machines. In case of too many applications, attendance will be granted based on prequalification.

**Prerequisites**

Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

**Recommendation**

- Knowledge of ProE (ideally in actual version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics

**Annotation**

After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

**Content:**

- Basics of multi-body and hydraulics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

**Literature:**

- Software guide books (PDFs)
- Information about wheel-type loader specifications

*Below you will find excerpts from events related to this course:*
Simulation of Coupled Systems
2114095, SS 2024, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content

- Knowledge of the basics of multi-body and hydraulic simulation programs
- Possibilities of coupled simulations
- Development of a simulation model by using the example of a wheel loader
- Documentation of the result in a short report

It is recommended to have:

- Knowledge of ProE (ideally in current version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics

- regular attendance: 21 hours
- total self-study: 92 hours

Literature
Weiterführende Literatur:

- Diverse Handbücher zu den Softwaretools in PDF-Form
- Informationen zum verwendeten Radlader
### 3.341 Course: Simulation of Coupled Systems - Advance [T-MACH-108888]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer  
Yusheng Xiang

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Competence Certificate**  
Preparation of semester report

**Prerequisites**  
none
### 3.342 Course: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

**Responsible:** Hon.-Prof. Dr. Thomas Schulenberg  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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### Events

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Legend: 🖥 Online, ⚽ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

### Competence Certificate

oral exam (ca. 15 min)

### Prerequisites

none

### Recommendation

Participation at LV-No. 2170490 "Combined Cycle Power Plants" (T-MACH-105444) is recommended.

Below you will find excerpts from events related to this course:

### Content

The training objective of the course is the qualification for a research-related professional activity in power plant engineering. On the basis of the learned fundamentals in thermodynamics, in instrumentation and control engineering, as well as on the basis of the acquired knowledge of design of combined cycle plants, the participants can operate a real combined cycle power plant. This application creates a deeper understanding of the dynamic processes of the power plant, the specific importance of the plant components and the limits of the load capacity of the components. Participants can optimize normal operation and analyze incidents. They can work self-organized and reflexive. They have communicative and organizational skills in teamwork, even under major technical challenges.

Start-up of the power plant from scratch; load changes and shut down; dynamic response of the power plant in case of malfunctions and of sudden load changes; manual operation of selected components.

### Organizational issues

Termine zum Simulatorpraktikum werden in der Vorlesung und per ILIAS am Semesterbeginn mit den Studenten vereinbart.

Appointments for the simulator internship are arranged with the students in the lecture and via ILIAS at the beginning of the semester.

### Literature

Vorlesungsskript und weitere Unterlagen der Vorlesung Gas- und Dampfkraftwerke.
Slides and other documents of the lecture Combined Cycle Power Plants.
3.343 Course: Smoothed Particle Hydrodynamics (SPH) in Computational Fluid Dynamics [T-MACH-111396]

Responsible: Dr.-Ing. Rainer Koch
Organisation: KIT Department of Mechanical Engineering
Institute of Thermal Turbomachinery
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Practical course / Koch

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
Successfull solution of tasks

Prerequisites
none

Recommendation
Prior knowledge of computational fluid dynamics, SPH method and LINUX.
### 3.344 Course: Solar Energy [T-ETIT-100774]

**Responsible:** Prof. Dr. Bryce Sydney Richards  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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<td>Solar Energy</td>
<td>Richards</td>
</tr>
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</table>

**Prerequisites**

Students not allowed to take either of the following modules in addition to this one: „Solarenergie” (M-ETIT-100476) and „Photovoltaik” (M-ETIT-100513).

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-ETIT-101939 - Photovoltaics must not have been started.
### 3.345 Course: Solar Thermal Energy Systems [T-MACH-106493]

**Responsible:** apl. Prof. Dr. Ron Dagan  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**

oral exam of about 30 minutes

**Prerequisites**

none

**Recommendation**

Literature

**Below you will find excerpts from events related to this course:**

**V Solar Thermal Energy Systems**

2189400, WS 23/24, 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 Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
- "Fundamentals of classical Thermodynamics", G. Van Wylen & R. E. Sonntag. Published by Wiley & Sons
3.346 Course: Solid State Reactions and Kinetics of Phase [T-MACH-107667]

**Responsible:** Dr. Peter Franke  
Prof. Dr. Hans Jürgen Seifert  

**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering  

<table>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
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 Conditions**
The following conditions have to be fulfilled:

1. **The course T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations must have been passed.**

**Recommendation**
Basic course in materials science and engineering
Basic course in mathematics
physical chemistry

**Below you will find excerpts from events related to this course:**

**Solid State Reactions and Kinetics of Phase Transformations**

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<td>Lecture / 🗣</td>
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**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

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
3.347 Course: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

**Responsible:** Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Prof. Dr.-Ing. Andreas Siebe

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

Oral exam in small groups (30 minutes)

**Prerequisites**
The precondition of this partial work is the successful processing of a case study (T-MACH-110396): Documentation and presentation of the overall results (15 minutes)

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-110396 - Strategic Product Development - Identification of Potentials of Innovative Products - Case Study must have been passed.

**Below you will find excerpts from events related to this course:**

**Strategic product development - identification of potentials of innovative products**

2146198, SS 2024, 2 SWS, Language: German, Open in study portal

**Content**

Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

**Organizational issues**

Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage
### Course: Strategic Product Development - Identification of Potentials of Innovative Products - Case Study [T-MACH-110396]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen  
Prof. Dr.-Ing. Andreas Siebe

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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<td>2146198</td>
<td>Strategic product development - identification of potentials of innovative products</td>
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**Exams**

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<td>Strategic Product Development - Identification of Potentials of Innovative Products - Case Study</td>
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</table>

**Legend:**  
🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
Successful processing of a case study (T-MACH-110396): documentation and presentation of the overall results (15 minutes)

**Below you will find excerpts from events related to this course:**

**Strategic product development - identification of potentials of innovative products**

2146198, SS 2024, 2 SWS, Language: German, Open in study portal

**Content**

Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

**Organizational issues**

Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage
3.349 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

 Responsible: Prof. Dr.-Ing. Luise Kärger
 Organisation: KIT Department of Mechanical Engineering
 Lightweight Design
 Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>2 SWS</td>
<td>Lecture / Practice</td>
<td>/ Kärger</td>
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</table>

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

Below you will find excerpts from events related to this course:

Structural Analysis of Composite Laminates
2113106, WS 23/24, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
To reduce fuel consumption and CO2 emissions, lightweight materials such as fiber-reinforced plastics (FRP) are increasingly being used in vehicle construction. The course is dedicated to the calculation of the material and structural behavior of FRP components with the following contents:

- Micromechanics and Homogenization of fibre-matrix-composite
- Macro mechanical behavior of individual layer
- Behaviour of multilayer laminate
- FE formulations
- Failure criteria
- Damage analysis
- Dimensioning of FRP parts

Aim of this lecture: The students understand the mechanical correlation between fibre-matrix-configuration and macroscopic material behavior. They can formulate the stress-strain / force-strain relation of an individual layer and of a multilayer laminate by approaches of first and higher order. The students know and can interpret and apply failure criteria and approaches to model damage progression. They know simple dimension strategies to design FRP components.
**Literature**


3.350 Course: Structural Materials [T-MACH-100293]

Responsible: Dr.-Ing. Stefan Guth
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Exams

| WT 23/24 | 76-T-MACH-100293 | Structural Materials | Guth |

Competence Certificate

Oral exam, about 25 minutes

Prerequisites

none
**3.351 Course: Superconductors for Energy Applications [T-ETIT-110788]**

**Responsible:** apl. Prof. Dr. Francesco Grilli  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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**Competence Certificate**  
oral exam approx. 30 minutes.

**Prerequisites**  
A basic knowledge of electromagnetism and thermodynamics is the only requirement. Previous knowledge of superconductivity is not necessary.  
"T-ETIT-106970 - Superconducting Materials for Energy Applications" must not be taken.
3 COURSES

Course: Superhard Thin Film Materials [T-MACH-102103]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Sven Ulrich</th>
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**Type**
- Oral examination

**Credits**
- 4

**Grading scale**
- Grade to a third

**Recurrence**
- Each winter term

**Version**
- 3

**Events**

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Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none

**Below you will find excerpts from events related to this course:**

**Superhard Thin Film Materials**
- 2177618, WS 23/24, 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 Boronitride
  - Materials of the system metall-boron-carbon-nitrogen-silicon

Recommendations: none
Organizational issues
Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 23.10.23.
Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 25.10.23.

Literature
G. Kienel (Herausgeber): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed
3.353 Course: Sustainable Product Engineering [T-MACH-105358]

Responsible: Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen  
Dr.-Ing. Karl-Friedrich Ziegahn

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Exams

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Competence Certificate

written exam (90 min)

Prerequisites

none

Recommendation

None

Below you will find excerpts from events related to this course:

Sustainable Product Engineering

2146192, SS 2024, 2 SWS, Open in study portal

Lecture (V)  
On-Site

Content

understanding of sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects

skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products

understanding of product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulation during the process of development of technical products

delivery of key skills such as team skills / project / self / presentation based on realistic projects

The goal of the lecture is to convey the main elements of sustainable product development in the economic, social and ecological context.

The students are able to ...

- identify and describe the sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects.
- discuss the skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products.
- understand the product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulation during the process of development of technical products.
- develop skills such as team skills / project / self / presentation based on realistic projects.
T 3.354 Course: System Dynamics and Control Engineering [T-ETIT-101921]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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Prerequisites

none
### 3.355 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

**Responsible:** apl. Prof. Dr. Ulrich Gengenbach  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Gengenbach</th>
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</table>

**Exams**

| WT 23/24 | 76-T-MACH-105555 | System Integration in Micro- and Nanotechnology | Gengenbach |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam (Duration: 30 min)

**Prerequisites**

none

Below you will find excerpts from events related to this course:

#### System Integration in Micro- and Nanotechnology I

2106033, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V) On-Site**

**Content**

- Introduction to system integration (fundamentals)
- Brief introduction to MEMS processes
- Flexures
- Surfaces and plasma processes for surface treatment
- Adhesive bonding in engineering
- Mounting techniques in electronics
- Molded Interconnect devices (MID)
- Functional Printing
- Low temperature cofired ceramics in system integration
- 3D-Integration in semiconductor technology

**Learning objectives:**

The students acquire basic knowledge of challenges and system integration technologies from mechanical engineering, precision engineering and electronics.

**Literature**

- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013
3.356 Course: System Integration in Micro- and Nanotechnology 2 [T-MACH-110272]

<table>
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**Responsible:** apl. Prof. Dr. Ulrich Gengenbach  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

### Events

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### Exams

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Legend: 🖥 Online, 🤖 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral exam, approx. 15 min.

**Prerequisites**

None

Below you will find excerpts from events related to this course:

**System Integration in Micro- and Nanotechnology 2**  
2105040, WS 23/24, 2 SWS, Language: German, Open in study portal

### Content

Introduction to system integration (novel processes and applications)  
Assembly of hybrid microsystems  
Packaging processes  
Applications:  
- Lab-on-chip systems  
- Microoptical systems  
- Silicon Photonics  

Novel integration processes:  
- Direct Laser Writing  
- Self Assembly

### Learning objectives

The students acquire knowledge of novel system integration technologies and their application in microoptic and microfluidic systems.

### Literature

N.-T. Nguyen, Fundamentals and Applications of Microfluidics, Artech House  
G. T. Reed, Silicon Photonics: An Introduction, Wiley
3.357 Course: Systematic Materials Selection [T-MACH-100531]

**Responsible:** Dr.-Ing. Stefan Dietrich  
Prof. Dr.-Ing. Volker Schulze  

**Organisation:** KIT Department of Mechanical Engineering  

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Exams**

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**Legend:**  
🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑️ Cancelled

**Competence Certificate**  
The assessment is carried out as a written exam of 2 h.

**Prerequisites**  
none

**Recommendation**  
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

*Below you will find excerpts from events related to this course:*

| **Systematic Materials Selection** | 2174576, SS 2024, 3 SWS, Language: German, Open in study portal | Lecture (V) | On-Site |

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)  
Module Handbook as of 23/02/2024
Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are developed. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

Learning objectives:
The students are able to select the best material for a given application. They are proficient in selecting materials on base of performance indices and materials selection charts. They can identify conflicting objectives and find sound compromises. They are aware of the potential and the limits of hybrid material concepts (composites, bimaterials, foams) and can determine whether following such a concept yields a useful benefit.

Requirements:
Wiling SPO 2007 (B.Sc.)
The course Material Science I [21760] has to be completed beforehand.

Wiling (M.Sc.)
The course Material Science I [21760] has to be completed beforehand.

Workload:
The workload for the lecture is 120 h per semester and consists of the presence during the lecture (30 h) as well as preparation and rework time at home (30 h) and preparation time for the oral exam (60 h).

Literature
Vorlesungsskriptum; Übungblätter; Lehrbuch: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7
### 3.358 Course: Systems Engineering for Automotive Electronics [T-ETIT-100677]

**Responsible:** Hon.-Prof. Dr. Jürgen Bortolazzi  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

<table>
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**Prerequisites**
none
Course: Technical Design in Product Development [T-MACH-105361]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen  
Dr.-Ing. Markus Schmid

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Competence Certificate**

Written exam (60 min)

Only dictionary is allowed

Below you will find excerpts from events related to this course:

**Content**

Introduction

Relevant parameters on product value in Technical Design  
Design in Methodical Development and Engineering and for a differentiated validation of products  
Design in the concept stage of Product Development  
Design in the draft and elaboration stage of Product Development  
Best Practice

After listening the module "technical design" the students should have knowledge about the basics of technical oriented design as an integral part of the methodical product development

The students have knowledge about ...

- the interface between engineer and designer.  
- all relevant human-product requirements as f. exp. demographic/ geographic and psychographic features, relevant perceptions, typical content recognition as well as ergonomic bases.  
- the approaches concerning the design of a product, product program or product system with focus on structure, form-, color- and graphic design within the phases of the design process.  
- the design of functions and supporting structures as well as the important interface between human and machine.  
- relevant parameters of a good corporate design.

**Organizational issues**

Die Veranstaltung findet 2024 nicht statt.
Literature
Markus Schmid, Thomas Maier
Technisches Interface Design
Anforderungen, Bewertung, Gestaltung.
2017
Hartmut Seeger
Design technischer Produkte, Produktprogramme und -systeme
Industrial Design Engineering.
2., bearb. und erweiterte Auflage.
ISBN: 3540236538
September 2005 - gebunden - 396 Seiten

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Technical energy systems for buildings 1: Processes &amp; components</td>
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Exams

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<th>Credits</th>
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<th>Recurrence</th>
<th>Version</th>
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</table>

Competence Certificate
oral exam, approx. 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

**Technical energy systems for buildings 1: Processes & components**

Lecture (V)  
Blended (On-Site/Online)

**Content**

Introduction to heating and cooling technologies for buildings, solar energy utilization in buildings (solar radiation, solar thermal energy, photovoltaics) and to energy storage in buildings (thermal and electric storage technologies). Topics covered:

- Burners, condensing and non-condensing boilers
- Cogeneration units for use in buildings
- Heat transformation: Fundamentals, vapor compression, absorption, adsorption
- Solar energy: Radiation, solar thermal collectors, photovoltaics
- Energy storage in buildings: thermal and electric storage

**Learning objectives:**

Students know relevant technical components of energy supply systems in buildings (heating and cooling, dehumidification). They know the energy conversion processes associated with these components and can estimate their energy efficiencies as well as the most important factors influencing efficiency.

Students are familiar with the underlying physics (mostly thermodynamics) of the relevant processes. They can derive relevant figures of merit from these principles. They know the degree of technological development for the various processes and components and are aware of current research and development objectives in this field.

**Oral exam:** about 25 min.

No tools

**Organizational issues**

Blockvorlesung 19.-23.02.2024, Campus Nord, Gebäude 521, Raum 220 (INR - Institut für Neutronenphysik und Reaktortechnik)

**Responsible:** Dr. Ferdinand Schmidt

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

| ST 2024 | 2158201 | Technical energy systems for buildings 2: System concepts | 2 SWS | Lecture / 🗣 | Schmidt |

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**Competence Certificate**
oral exam, approx. 30 minutes

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Technical energy systems for buildings 2: System concepts**
2158201, SS 2024, 2 SWS, Language: German, Open in study portal

**Lecture (V)**
On-Site

**Content**
Introduction of relevant figures of merit for technical energy systems in buildings. Description of different system concepts for energy supply of buildings (heating, cooling, dehumidification) and evaluation according to figures of merit. Systems covered include

- Heat pumps and heat pump systems including combination with solar thermal energy
- Cogeneration and trigeneration system (heating, cooling, power)
- Solar thermal systems: Domestic hot water, heating support, cooling and dehumidification
- District heating systems including solar thermal heat
- Photovoltaics and heat pump systems including thermal and battery storage
- Grid-reactive building technology: Smart-Metering, Smart Home, Smart Grid

**Learning outcomes:**
Students are able to develop system concepts for technical energy systems in buildings and to rationally design such systems. They know the relevant figures of merit for an energy-related as well as an economical or combined evaluation of systems, and know how to employ these figures of merit in sizing systems and components. Students are able to employ plausibility checks and to give rough estimates on building energy concepts and they know which technologies can be combined for highly efficient system combinations.

**Workload:**
30 hours course attendance, 90 hours self-study

Oral exam appr. 25 minutes
### 3.362 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-112912]

**Responsible:** Prof. Dr. Ulrich Maas  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Competence Certificate**  
Written exam; approx. 3 hours

**Prerequisites**  
Successful participation in the tutorial (T-MACH-112910 - Tutorial Technical Thermodynamics and Heat Transfer I)

**Modeled Conditions**  
The following conditions have to be fulfilled:

1. The course T-MACH-112910 - Tutorial Technical Thermodynamics and Heat Transfer I must have been passed.

**Annotation**  
It will be offered for the first time in the winter semester of 2024/2025.
3.363 Course: Technical Thermodynamics and Heat Transfer II [T-MACH-112913]

**Responsible:** Prof. Dr. Ulrich Maas

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Competence Certificate**
Written exam; approx. 3 hours

**Prerequisites**
Successful participation in the tutorial (T-MACH-112911 - Tutorial Technical Thermodynamics and Heat Transfer II)

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-112911 - Tutorial Technical Thermodynamics and Heat Transfer II must have been passed.

**Annotation**
It will be offered for the first time in the summer semester of 2025.
**3.364 Course: Technology of Steel Components [T-MACH-105362]**

**Responsible:** Prof. Dr.-Ing. Volker Schulze  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<th>Lecture /</th>
<th>Schulze</th>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
Oral exam, about 25 minutes

**Prerequisites**
none

Below you will find excerpts from events related to this course:

**Technology of steel components**
2174579, SS 2024, 2 SWS, Language: German, Open in study portal

**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


V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005
Course: Ten Lectures on Turbulence [T-MACH-105456]

**Responsible:** Dr. Ivan Otic  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Exams**

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**Competence Certificate**  
oral exam, 20 min

**Prerequisites**

none

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### Content

**Contents:**

The course is aimed of giving the fundamentals of turbulence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent ows are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear ows and wall-bounded turbulent ows are discussed. Turbulence modelling approaches and simulation methods are introduced.

1. Introduction  
2. Turbulent transport of momentum and heat  
3. Statistical description of turbulence  
4. Scales of turbulent flows  
5. Homogeneous turbulent shear flows  
6. Free turbulent shear flows  
7. Wall-Bounded turbulent flows  
8. Turbulence Modelling  
9. Reynolds Averaged Navier-Stokes (RANS) Simulation Approach  
10. Large Eddy Simulation (LES) Approach

**Objectives:**

At the completion of this course, students

- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling
- are able to derive RANS and LES transport equations
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems.
- able to formulate an own turbulence model and implement it into the opensource computational fluid dynamics software OpenFOAM.

**Literature**

Reference texts:
- Lecture Notes
- Presentation slides

Recommended Books:
**3.366 Course: Theory of Probability [T-ETIT-101952]**

**Responsible:** Dr.-Ing. Holger Jäkel  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the KIT Department of Electrical Engineering and Information Technology

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Prerequisites**

Contents of higher mathematics are necessary (e.g. M-MATH-101731 und M-MATH-101732).
3.367 Course: Theory of Stability [T-MACH-105372]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Competence Certificate**

oral exam, 30 min.

**Prerequisites**

none

**Recommendation**

Vibration theory, Mathematical Methods of Vibration Theory

**Below you will find excerpts from events related to this course:**

### Theory of Stability

2163113, SS 2024, 2 SWS, Language: German, [Open in study portal](#)  

**Content**

- Basic concepts of stability
- Lyapunov's functions
- Direct lyapunov's methods
- Stability of equilibria positions
- Attraction area of a stable solution
- Stability according to the first order approximation
- Systems with parametric excitation
- Stability criteria in the control theory

**Organizational issues**

Die Vorlesung Stabilitätstheorie wird im Sommersemester 2024 nicht angeboten.

**Literature**

3.368 Course: Thermal Solar Energy [T-MACH-105225]

**Responsible:** N.N.  
**Organisation:** KIT Department of Mechanical Engineering

| Part of: | M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering |

| Events | 
|---------|-----------------|
| WT 23/24 | 2169472 | Thermal Solar Energy | 2 SWS | Lecture / 🗣 | Stieglitz, Dagan |

| Exams | 
|---------|-----------------|
| WT 23/24 | 76-T-MACH-105225 | Thermal Solar Energy |

**Competence Certificate**
Oral examination of about 30 minutes

**Prerequisites**
none

**Below you will find excerpts from events related to this course:**

**Thermal Solar Energy**  
2169472, WS 23/24, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
On-Site

**Content**

In detail:
1. Introduction to energy requirements and evaluation of the potential use of solar thermal energy.
2. Primary energy source SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).
5. Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits.
   optional
6. Low temperature solar thermal systems: collector types, methods for system simulation, planning and dimensioning of systems, system design and stagnation scenarios.
7. High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes

The lecture elaborates the basics of the solar technology and the definition of the major wordings and its physical content such as radiation, thermal use, insulation etc.. Further the design of solar collectors for different purposes is discussed and analyzed. The functional principle of solar plants is elaborated before at the end the ways for solar cooling is discussed.

The aim of the course is to provide the basic physical principles and the derivation of key parameters for the individual solar thermal use. This involves in addition to the selective absorber, mirrors, glasses, and storage technology. In addition, a utilization of solar thermal energy means an interlink of the collector with a thermal-hydraulic circuit and a storage. The goal is to capture the regularities of linking to derive efficiency correlations as a function of their use and evaluate the performance of the entire system.

**Recommendations / previous knowledge**
Basics in heat and mass transfer, material science and fluid mechanics, desirable are reliable knowledge in physics in optics and thermodynamics

Oral exam of about 25 minutes, no tools or reference materials may be used during the exam
**Organizational issues**
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

**Literature**
Bereitstellung des Studienmaterials in gedruckter und elektronischer Form.
Stieglitz & Heinzel; Thermische Solarenergie - Grundlagen - Technologie - Anwendungen. Springer Vieweg Verlag. 711 Seiten.
ISBN 978-3-642-29474-7
### 3.369 Course: Thermal Turbomachines I [T-MACH-105363]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Institute of Thermal Turbomachinery**  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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| Competence Certificate
| oral exam, duration 30 min. |

| Prerequisites
| none |

*Below you will find excerpts from events related to this course:*

#### Thermal Turbomachines I

- **2169453, WS 23/24, 3 SWS, Language: English**, [Open in study portal](#)
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

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.

regular attendance: 31,50 h
self-study: 64,40 h

Recommendations:
Recommended in combination with the lecture 'Thermal Turbomachines II'.

Examination:
oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Organizational issues
Vorlesung wird nur noch in Englisch gehalten ab WS 2023/24.
Aufzeichnungen in Deutsch aus früheren Vorlesungen werden weiter zur Verfügung gestellt.

Literature
Vorlesungsskript (erhältlich im Internet)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
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'.
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.

regular attendance: 31.50 h
self-study: 64.40 h

Exam:
oral
Duration: approximately 30 min
no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im Internet)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
3.70 Course: Thermal Turbomachines II [T-MACH-105364]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer

**Organisation:** KIT Department of Mechanical Engineering

**Institute of Thermal Turbomachinery**

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**

oral exam, duration: 30 min.

**Prerequisites**

none

*Below you will find excerpts from events related to this course:*

**Thermal Turbomachines II (in English)**

2170553, SS 2024, 3 SWS, Language: English, [Open in study portal](#)
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)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
3.371 Course: Thermal-Fluid-Dynamics [T-MACH-106372]

Responsible: Dr. Sebastian Ruck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

### Events

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Legend: 🖥 Online, 📦 Blended (On-Site/Online), 🗣 On-Site, ⏸ Cancelled

### Competence Certificate

oral exam of about 30 minutes

### Prerequisites

none

Below you will find excerpts from events related to this course:

#### Thermal-Fluid-Dynamics

2189423, WS 23/24, 2 SWS, Language: German, Open in study portal

#### Content

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Velocity and temperature laws in boundary layers
- Convective heat transfer of external and internal flows
- Heat transfer analogies (Prandtl-, von Kármán, Martinelli,...)
- Methods for enhancing heat transfer
- Strategies and methods for investigation of thermal-hydraulics in R&D

The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. On the basis of the conservation equations and the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, with scaling rules the laminar and turbulent thermal boundary layer equations are introduced. In the following, velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed and the influence of roughness and surface design are shown. Concepts of state-of-the-art turbulence modelling and their applicability for different conditions or different heat transfer fluids (e.g. liquid metals, gas, oil) are described. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Design options to enhance the efficiency and effectiveness of heat exchangers are discussed.

The objectives of the lecture are the fundamentals of thermal-hydraulics for describing and modelling convective fluid flow as occurring in power engineering components. A major objective is the description of the convective heat transfer for external and internal flows. A key issue is the transfer of analytic models and empirical results into “state of the art” computational tools and their validation by advanced experimental methods. Within the scope of the course, the students learn (a) to develop differential equation for thermal-hydraulic problems and to describe the thermal flow field by means of dimensionless parameters, (b) to transfer a real problem to an experiment or computational model, (c) to develop analogies and correlations for heat transfer processes of forced convection, (d) to select adequate computational methods/models, (e) to evaluate and select experiments including measurement techniques with adequate instrumentation for thermal-hydraulic problems and (f) to know design option for an efficient and effective heat exchange.

Attendance time: 21 h
Preparation/follow-up time of lectures, exam preparation: 90h

Oral exam of about 30 min.
Literatur
### 3.372 Course: Thesis (BSc) [T-MACH-110107]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104840 - Project

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#### Competence Certificate
The Thesis work consists of a written Thesis work and an presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The Thesis work is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

#### Prerequisites
none

#### Final Thesis
This course represents a final thesis. The following periods have been supplied:

- **Submission deadline**: 3 months  
- **Maximum extension period**: 1 months  
- **Correction period**: 6 weeks
3.373 Course: Thesis (MSc) [T-MACH-109880]

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-104840 - Project

**Type**
- Final Thesis

**Credits**
- 30

**Grading scale**
- Grade to a third

**Recurrence**
- Each term

**Version**
- 1

**Competence Certificate**
The Thesis (MSc) work consists of a written Thesis work and an presentation of a scientific subject chosen by the student himself/herself or given by the supervisor. The Thesis work is designed to show that the student is able to deal with a problem of his/her subject area in an independent manner and within the given period of time using scientific methods.

**Prerequisites**
none

**Final Thesis**
This course represents a final thesis. The following periods have been supplied:

- **Submission deadline** 6 months
- **Maximum extension period** 1 months
- **Correction period** 6 weeks
3.74 Course: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

Responsible: Dr. Patric Gruber  
Prof. Dr. Christoph Kirchlechner  
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ☢️ On-Site, ✗ Canceled

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Recommendation
preliminary knowledge in materials science, physics and mathematics

Below you will find excerpts from events related to this course:

**Thin film and small-scale mechanical behavior**
2178123, SS 2024, 2 SWS, Language: English, Open in study portal

Content
1. Introduction: Application and properties of micro- and nanosystems; Overview on size effects
2. Fundamentals: Dislocation plasticity (definition of a dislocation; dislocation density, mobility, dislocation sources, statistical aspects incl. SSDs and GNDs).
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.
7. Nanocrystalline materials: Synthesis, outstanding mechanical properties

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.

regular attendance: 22,5 hours
self-study: 97,5 hours
oral exam ca. 30 minutes

Literature
2. L.B. Freund and S. Suresh: „Thin Film Materials“
### 3.375 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

#### Responsible:
Prof. Dr.-Ing. Günter Leister

#### Organisation:
KIT Department of Mechanical Engineering

#### Part of:
M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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#### Events

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#### Exams

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</table>

#### Legend:
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 👤 On-Site
- ❌ Cancelled

#### Competence Certificate

Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

#### Prerequisites

none

#### Below you will find excerpts from events related to this course:

### Content

1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology including Design and manufacturing methods, Wheeltesting
7. Tire pressure: Indirect and direct measuring systems
8. Tire testing subjective and objective

#### Learning Objectives:

The students are informed about the interactions of tires, wheels and chassis. They have an overview of the processes regarding the tire and wheel development. They have knowledge of the physical relationships.

#### Organizational issues

Voraussichtliche Termine, nähere Informationen und eventuelle Terminänderungen:
siehe Institutshomepage.

#### Literature

Manuskript zur Vorlesung

Manuskript to the lecture
3.376 Course: Tractors [T-MACH-105423]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer
Hon.-Prof. Dr. Martin Kremmer

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌠ Cancelled

**Competence Certificate**
The assessment consists of a written exam taking place in the recess period (90 min).

**Prerequisites**
none

**Recommendation**
Basic knowledge in mechanical engineering.
Annotation

Learning Outcomes

After completion of the course the Students know:

- important problems in agritechnological developments
- Customer requirements and their implementation in tractors
- Tractor technology in width and depth

Content

Tractors are one of the most underestimated vehicles in regard to performance and technics. Almost none vehicle is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies.

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

Literature

- K. T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

Below you will find excerpts from events related to this course:
Content
Tractors are one of the most underestimated vehicles in regard to performance and technics. Almost none vehicle is as multifunctional and fulfilled with high-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies.

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In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

basic knowledge in mechanical engineering

- regular attendance: 21 hours
- self-study: 92 hours

Organizational issues
Ort/Zeit siehe Institutshomepage

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960
3.377 Course: Tribology [T-MACH-105531]

**Responsible:** Prof. Dr. Martin Dienwiebel  
Prof. Dr.-Ing. Matthias Scherge

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<th>5 SWS</th>
<th>Lecture / Practice ( / )</th>
<th>Dienwiebel, Scherge</th>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

oral examination (ca. 40 min)

no tools or reference materials

**Prerequisites**

admission to the exam only with successful completion of the exercises [T-MACH-109303]

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-109303 - Exercises - Tribology must have been passed.

**Recommendation**

preliminary knowledge in mathematics, mechanics and materials science

_Below you will find excerpts from events related to this course:_

**Tribology**

2181114, WS 23/24, 5 SWS, Language: German, Open in study portal
3 COURSES

Course: Tribology [T-MACH-105531]

Content

- Chapter 1: Friction
  - adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  - plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication
  - base oils, Strieber plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  - friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  - profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  - multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

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


**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
Prof. Dr.-Ing. Bettina Frohnapfel

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**

Successfully passing the Tutorial is a prerequisite for taking part in the exam "Continuum Mechanics of Solids and Fluids" (T-MACH-110377).

For students of Mechanical Engineering (BSc) that have chosen the Major Field "Continuum Mechanics" and for students of Material Science and Material Technology (BSc) the prerequisites consist of successfully solving the written homework sheets as well as the computational homework sheets during the associated computer tutorials.

For students of Mechanical Engineering that have chosen a different Major Field of students from different fields of study the prerequisites consist of successfully solving only the written homework sheets.

**Prerequisites**

None

**Annotation**

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) and students of the bachelor's degree program in material science and material technology will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

**Below you will find excerpts from events related to this course:**

**Tutorial Continuum mechanics of solids and fluids**

2161253, WS 23/24, 1 SWS, Language: German, [Open in study portal](#)

**Practice (Ü)**

On-Site

**Content**

Please refer to the lecture "Continuum mechanics of solids and fluids".

**Literature**

Siehe Vorlesung "Kontinuumsmechanik der Festkörper und Fluide".

Please refer to the lecture "Continuum mechanics of solids and fluids".
### 3.379 Course: Tutorial Engineering Mechanics II [T-MACH-100284]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
Dr.-Ing. Tom-Alexander Langhoff

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Legend:** 🖥 Online, ☐ Blended (On-Site/Online), 🗽 On-Site, ✗ Cancelled

**Competence Certificate**  
Successful solution of worksheets. Details are given in the first lecture "Engineering Mechanics II"  
Passing this course allows to register to the exam "Engineering Mechanics II" (see T-MACH-100283).

**Prerequisites**  
None

**Below you will find excerpts from events related to this course:**

#### Tutorial Engineering Mechanics II  
2162251, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Content**  
see lecture Engineering Mechanics II

**Literature**  
Siehe Vorlesung Technische Mechanik II

#### Engineering Mechanics II (Tutorial)  
3162011, SS 2024, 2 SWS, Language: English, [Open in study portal](#)

**Content**  
see lecture "Engineering Mechanics II"

**Literature**  
see lecture "Engineering Mechanics II"

Responsible: N.N.
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Competence Certificate
Passing this course allows to register to the exam "Engineering Mechanics III" (see T-MACH-112906).

Prerequisites
none
3.381 Course: Tutorial Introduction to the Finite Element Method [T-MACH-110330]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Events

| ST 2024 | 2162257 | Tutorial Introduction to the Finite Element Method | 1 SWS | Practice | Lauff, Langhoff, Böhlke, Klein |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

Successful participation in this course allows for registration to the Exam "Introduction to the Finite Element Method" (see 76-T-MACH-105320)

For students of Mechanical Engineering (BSc) that have chosen the Major Field "Continuum Mechanics" the prerequisites consist of successfully solving the written homework sheets as well as the computational homework sheets during the associated computer tutorials.

For students of Mechanical Engineering that have chosen a different Major Field and for students from different fields of study the prerequisites consist of successfully solving only the written homework sheets.

Annotation

Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials are expected.

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

Below you will find excerpts from events related to this course:

**Tutorial Introduction to the Finite Element Method**

2162257, SS 2024, 1 SWS, Language: German, Open in study portal

Content

See lecture "Introduction to the Finite Element Method"

Literature

siehe Vorlesung "Einführung in die Finite-Elemente-Methode"
3.382 Course: Tutorial Mathematical Methods in Continuum Mechanics [T-MACH-110376]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Type**

- Completed coursework

**Credits** 2

**Grading scale** pass/fail

**Recurrence** Each winter term

**Expansion** 1 terms

**Version** 2

**Events**

| Events       | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion |
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| Exams        |         |               |            |           |         |               |            |           |         |               |            |           |         |               |            |           |         |               |            |           |         |               |            |           |         |               |            |           |         |

**Exams**

| Exams       | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion | Credits | Grading scale | Recurrence | Expansion |
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| WT 23/24    | 76-T-MACH-110376 | Tutorial Mathematical Methods in Continuum Mechanics | Böhlke |

**Legend:** ⏩ Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Successfully solving the homework sheets. Details are announced in the first lecture.

**Prerequisites**

None

Below you will find excerpts from events related to this course:

**Tutorial Mathematical Methods in Continuum Mechanics**

2161255, WS 23/24, 2 SWS, Language: German, Open in study portal

**Practice (Ü)**

- On-Site

**Content**

See "Mathematical Methods in Continuum Mechanics"

**Literature**

Siehe "Mathematische Methoden der Kontinuumsmechanik"
### 3.383 Course: Tutorial Mathematical Methods in Micromechanics [T-MACH-110379]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Competence Certificate**

Successfully solving the homework sheets. Details are given in the first lecture.
### 3.384 Course: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
**Organisation:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Competence Certificate**
Written homework problems

Successful participation in this course allows for registration to the Exam "Nonlinear Continuum Mechanics" (see 76-T-MACH-111026)

**Prerequisites**
none
### 3.385 Course: Tutorial Technical Thermodynamics and Heat Transfer I [T-MACH-112910]

**Responsible:** Prof. Dr. Ulrich Maas  
**Organisation:** KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>pass/fail</td>
<td>Each winter term</td>
<td>1 terms</td>
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**Competence Certificate**  
Successful completion of written preliminary tests.

**Annotation**  
It will be offered for the first time in the winter semester of 2024/2025.
Course: Tutorial Technical Thermodynamics and Heat Transfer II [T-MACH-112911]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>1 terms</td>
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<tr>
<td>Version</td>
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Competence Certificate
Successful completion of written preliminary tests.

Annotation
It will be offered for the first time in the summer semester of 2025.
3.387 Course: Two-Phase Flow and Heat Transfer [T-MACH-105406]

**Responsible:** Hon.-Prof. Dr. Thomas Schulenberg
Dr. Martin Wörner

**Organisation:** KIT Department of Chemical and Process Engineering
KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>Grade to a third</td>
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**Competence Certificate**
oral exam, duration: approximately 30 minutes
no tools or reference materials may be used during the exam

**Prerequisites**
none
3.388 Course: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

**Responsible:** Dr. Christian Day  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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Legend: 🖥 Online, ☐ Blended (On-Site/Online), ☑ On-Site, ✗ Cancelled

**Competence Certificate**  
oral examination, approx. 20 Minutes, any time in the year

**Prerequisites**  
none

**Recommendation**  
Knowledge in “Fusion Technology A”

Below you will find excerpts from events related to this course:

**Vacuum and Tritium Technology in Nuclear Fusion**  
2190499, SS 2024, 2 SWS, Language: German/English, Open in study portal

**Content**  
Introduction  
Tritium Handling  
Tritium Plant Technologies  
Tritium and Breeding  
Fundamentals of Vacuum Science and Technology  
Fusion Vacuum systems  
Matter Injection into the Plasma Chamber  
Fuel Cycle of ITER and DEMO

The students have acquired the necessary understanding in order to design and size facilities for tritium operation. They understand the process steps in the tritium plant of a fusion reactor for tritium removal and tritium recovery from tritiated exhaust gas. Furthermore, the students have understood the fundamentals of vacuum physics and are able to design and choose vacuum pumps properly.

recommended is Knowledge in "Fusion Technology A"  
oral exam of about 20 min

**Organizational issues**  
Anmeldung bis 20. April via E-Mail an: christian.day@kit.edu  
Raum wird bekanntgegeben.
3.389 Course: Vehicle Comfort and Acoustics I [T-MACH-105154]

**Responsible:** Prof. Dr. Frank Gauterin  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

### Events

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<td>Each winter term</td>
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**Exams**

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<td>Lecture / On-Site</td>
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### Competence Certificate

**Oral Examination**

Duration: approx. 30 to 40 minutes  
Auxiliary means: none

### Prerequisites

Can not be combined with lecture T-MACH-102206

### Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-102206 - Vehicle Ride Comfort & Acoustics I must not have been started.

**Below you will find excerpts from events related to this course:**

**Vehicle Comfort and Acoustics I**

2113806, WS 23/24, 2 SWS, Language: German, Open in study portal

**Content**

1. Perception of noise and vibrations  
2. Fundamentals of acoustics and vibrations  
3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations  
4. The relevance of tire and chassis for the acoustic and mechanical driving comfort: phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

**Learning Objectives:**

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.
Organizational issues
Das Vorlesungsmaterial wird auf ILIAS bereitgestellt. Das ILIAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2114856] kombiniert werden.
Can not be combined with lecture [2114856]

Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

Vehicle Ride Comfort & Acoustics I
2114856, SS 2024, 2 SWS, Language: English, Open in study portal

Content
1. Perception of noise and vibrations
2. Fundamentals of acoustics and vibrations
3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations
4. The relevance of tire and chasis for the acoustic and mechanical driving comfort: phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

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The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Organizational issues
the lectures are available as a video stream.
You will find the lecture material and the videos on ILIAS. To get the ILIAS password, refer to https://fast-web-01.fast.kit.edu/PasswoerterIlias/

Kann nicht mit der Veranstaltung [2113806] kombiniert werden.
Can not be combined with lecture [2113806]

Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
### 3.390 Course: Vehicle Comfort and Acoustics II [T-MACH-105155]

**Responsible:** Prof. Dr. Frank Gauterin  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Exams**

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**Competence Certificate**

Oral Examination

Duration: approx. 30 to 40 minutes

Auxiliary means: none

**Prerequisites**

Can not be combined with lecture T-MACH-102205

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-102205 - Vehicle Ride Comfort & Acoustics II must not have been started.

**Below you will find excerpts from events related to this course:**

**Vehicle Comfort and Acoustics II**

2114825, SS 2024, 2 SWS, Language: German, [Open in study portal](#)
Content

1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
   - phenomena
   - influencing parameters
   - types of construction
   - optimization of components and systems
   - conflicts of goals
   - methods of development

3. Noise emission of motor vehicles
   - noise stress
   - sound sources and influencing parameters
   - legal restraints
   - optimization of components and systems
   - conflict of goals
   - methods of development

Learning Objectives:
The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Organizational issues

Die Vorlesung wird als Videostream zur Verfügung gestellt. Sie finden den Videostream und das Vorlesungsmaterial auf ILLAS. Das ILLAS-Passwort erhalten Sie unter https://fast-web-01.fast.kit.edu/Passwoerterillas/

Kann nicht mit der Veranstaltung [2114857] kombiniert werden.

Can not be combined with lecture [2114857]

Literature

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

Vehicle Ride Comfort & Acoustics II
2114857, SS 2024, 2 SWS, Language: English, Open in study portal

Content

1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
   - phenomena
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**Organizational issues**

The lectures are available as a video stream.

You will find the lecture material and the videos on ILIAS. To get the ILIAS password, refer to [https://fast-web-01.fast.kit.edu/PasswoerterIlias/](https://fast-web-01.fast.kit.edu/PasswoerterIlias/)

Can not be combined with lecture [2114825].

**Literature**

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.

**Responsible:** Prof. Dr.-Ing. Frank Henning

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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**Competence Certificate**

Written exam; Duration approx. 90 min

**Prerequisites**

none

**Recommendation**

none

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

Below you will find excerpts from events related to this course:

**Vehicle Lightweight design – Strategies, Concepts, Materials**

2113102, WS 23/24, 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


3.392 Course: Vehicle Ride Comfort & Acoustics I [T-MACH-102206]

**Responsible:** Prof. Dr. Frank Gauterin  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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**Events**

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**Exams**

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**Legend:** 📚 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

Oral examination

**Prerequisites**

Can not be combined with lecture Fahrzeugkomfort und -akustik I T-MACH-105154

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105154 - Vehicle Comfort and Acoustics I must not have been started.

**Below you will find excerpts from events related to this course:**

**Vehicle Ride Comfort & Acoustics I**

- 2114856, SS 2024, 2 SWS, Language: English, [Open in study portal](https://fast-web-01.fast.kit.edu/PasswoerterIlias/)

**Content**

1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

4. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chassis for the acoustic and mechanical driving comfort: phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

**Learning Objectives:**

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chassis regarding driving comfort and acoustic under consideration of goal conflicts.

**Organizational issues**

*The lectures are available as a video stream.*

You will find the lecture material and the videos on ILIAS. To get the ILIAS password, refer to [https://fast-web-01.fast.kit.edu/PasswoerterIlias/](https://fast-web-01.fast.kit.edu/PasswoerterIlias/)

Kann nicht mit der Veranstaltung [2113806] kombiniert werden.

Can not be combined with lecture [2113806]
Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
Course: Vehicle Ride Comfort & Acoustics II [T-MACH-102205]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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Events

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Competence Certificate
Oral examination

Prerequisites
Can not be combined with lecture Fahrzeugkomfort und -akustik II T-MACH-105155

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105155 - Vehicle Comfort and Acoustics II must not have been started.

Below you will find excerpts from events related to this course:

Vehicle Ride Comfort & Acoustics II
2114857, SS 2024, 2 SWS, Language: English, Open in study portal

Lecture (V)
Online

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
   - phenomena
   - influencing parameters
   - types of construction
   - optimization of components and systems
   - conflicts of goals
   - methods of development

3. Noise emission of motor vehicles
   - noise stress
   - sound sources and influencing parameters
   - legal restraints
   - optimization of components and systems
   - conflict of goals
   - methods of development

Learning Objectives:
The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.
**Organizational issues**

*the lectures are available as a video stream.*

You will find the lecture material and the videos on ILIAS. To get the ILIAS password, refer to [https://fast-web-01.fast.kit.edu/PasswoerterIlias/](https://fast-web-01.fast.kit.edu/PasswoerterIlias/)

Can not be combined with lecture [2114825].

**Literature**

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.
3.394 Course: Vehicle Systems for Urban Mobility [T-MACH-113069]

**Responsible:** Prof. Dr.-Ing. Martin Cichon  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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**Events**

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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

- Oral examination
- Duration: approx. 20 minutes
- No tools or reference material may be used during the exam.
3.395 Course: Vibration Theory [T-MACH-105290]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>Vibration Theory</td>
<td>2 SWS</td>
<td>Fidlin, Römer</td>
<td></td>
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</tr>
<tr>
<td>ST 2024</td>
<td>Vibration Theory</td>
<td>2 SWS</td>
<td>Fidlin</td>
<td></td>
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</tr>
</tbody>
</table>

**Compentence Certificate**

written exam, 180 min.

**Prerequisites**

none

**Below you will find excerpts from events related to this course:**

### Vibration Theory

**2161212, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)**

**Lecture (V)**

**Content**

Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.


Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

**Literature**

Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd. 1 und Bd. 2, Berlin, 1987


### Übungen zu Technische Schwingungslehre

**2161213, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)**

**Practice (Ü)**

**Content**

Exercises related to the lecture
Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Events**

<table>
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<th>3122031</th>
<th>Virtual Engineering (Specific Topics)</th>
<th>2 SWS</th>
<th>Lecture / T</th>
<th>Ovtcharova, Maier</th>
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**Exams**

<table>
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<th>76-T-MACH-105381</th>
<th>Virtual Engineering (Specific Topics)</th>
<th>Ovtcharova</th>
</tr>
</thead>
</table>

**Competence Certificate**

oral exam, approx. 20 min.

**Prerequisites**

none

Below you will find excerpts from events related to this course:

**Virtual Engineering (Specific Topics)**

3122031, SS 2024, 2 SWS, Language: English, Open in study portal

**Lecture (V) On-Site**

**Content**

Students can

- explain the basics of virtual engineering and name exemplary modeling tools and assign them to the corresponding methods and processes

- Formulate validation questions in the product development process and name obvious solution methods

- explain the basics of systems engineering and establish the connection to the product development process

- explain individual methods of the digital factory and present the functions of the digital factory in the context of the product creation process

- explain the theoretical and technical basics of Virtual Reality technology and show the connection to Virtual Engineering

**Organizational issues**

Zeit und Ort der Lehrveranstaltung siehe ILIAS / Time and place of the course see ILIAS.

**Literature**

Lecture slides / Vorlesungsfolien
3.397 Course: Virtual Engineering I [T-MACH-102123]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Each winter term</td>
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<th>Version</th>
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<td>Lecture</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>3</td>
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<tr>
<td>Exercises Virtual Engineering I</td>
<td>Practice</td>
<td>2 SWS</td>
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<td>Each winter term</td>
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**Exams**

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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Lecture</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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<tr>
<td>Virtual Engineering I</td>
<td>Practice</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**

Written examination 90 min.

**Prerequisites**

None

**Below you will find excerpts from events related to this course:**

**Virtual Engineering I**

2121352, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)  
**Lecture (V)**  
On-Site

**Content**

The course includes:

- Conception of the product (system approaches, requirements, definitions, structure)
- Generation of domain-specific product data (CAD, ECAD, software, ...) and AI methods
- Validation of product properties and production processes through simulation
- Digital twin for optimization of products and processes using AI methods

After successful attendance of the course, students can:

- Conceptualize complex systems with the methods of virtual engineering and continue the product development in different domains
- Model the digital product with regard to planning, design, manufacturing, assembly and maintenance.
- Use validation systems to validate product and production in an exemplary manner.
- Describe AI methods along the product creation process.

**Literature**

Vorlesungsfolien / Lecture slides

**Exercises Virtual Engineering I**

2121353, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)  
**Practice (Ü)**  
On-Site

**Content**

The theoretical Konzepts and contents of the lecture will be trained within practical relevance by basic functionalities of VE System solutions.

**Organizational issues**

Practice dates will probably be offered on different afternoons (14:00 - 17:15) in two-week intervals at IMI / Übungstermine werden voraussichtlich an unterschiedlichen Nachmittagen (14:00 - 17:15) in zweiwöchigem Rhythmus am IMI angeboten.
Literature
Exercise script / Übungsskript
3.398 Course: Virtual Engineering II [T-MACH-102124]

**Responsible:** Prof. Dr.-Ing. Jivka Ovtcharova  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

**Events**

<table>
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<td>Virtual Engineering II</td>
<td>2/1 SWS Lecture / Practice ( / )</td>
<td>Häfner, Ovtcharova</td>
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<tr>
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<td>76-T-MACH-102124</td>
<td>Virtual Engineering II</td>
<td>Ovtcharova, Häfner</td>
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<td>76-T-MACH-102124-mdl</td>
<td>Virtual Engineering II</td>
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<tr>
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<td>76-T-MACH-102124</td>
<td>Virtual Engineering II</td>
<td>Ovtcharova, Häfner</td>
<td></td>
</tr>
</tbody>
</table>

**Competence Certificate**  
Written examination 90 min.

**Prerequisites**  
None

**Below you will find excerpts from events related to this course:**

**Virtual Engineering II**  
2122378, SS 2024, 2/1 SWS, Language: English, [Open in study portal](#)  
Lecture / Practice (VÜ) On-Site

**Content**  
The course includes:

- Fundamentals (Computer Graphics, VR, AR, MR)
- Hardware and Software Solutions
- Virtual Twin, Validation and application

After successful attendance of the course, students can:

- describe Virtual Reality concepts, as well as explaining and comparing the underlying technologies
- discuss the modeling and computer-internal picture of a VR scene and explain the operation of the pipeline to visualize the scene
- designate different systems to interact with a VR scene and assess the pros and cons of manipulation and tracking devices
- differentiate between static, dynamic and functional Virtual Twins
- describe applications and validation studies with Virtual Twins in the area of building and production

**Organizational issues**  
Zusätzliche Übungszeiten (1 SWS) werden zu Vorlesungsbegin bekannt gegeben / Additional practice times (1 SWS) will be announced at the beginning of the lecture.

**Literature**  
Vorlesungsfolien / Lecture slides
3 COURSES

3.399 Course: Virtual Reality Practical Course [T-MACH-102149]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
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<td>Each term</td>
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**Events**

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<th>2123375</th>
<th>Virtual Reality Practical Course</th>
<th>3 SWS</th>
<th>Project (P / 🗣)</th>
<th>Ovtcharova, Häfner</th>
</tr>
</thead>
</table>

**Exams**

| WT 23/24 | 76-T-MACH-102149 | Virtual Reality Practical Course | Ovtcharova, Häfner |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
Assessment of another type (graded)

**Prerequisites**
None

**Annotation**
Number of participants is limited

Below you will find excerpts from events related to this course:

**Virtual Reality Practical Course**
2123375, WS 23/24, 3 SWS, Language: German/English, Open in study portal

**Content**

- Introduction in Virtual Reality (hardware, software, applications)
- Exercises in the task specific software systems
- Autonomous project work in the area of Virtual Reality in small groups

**Organizational issues**
Siehe Homepage zur Lehrveranstaltung

**Literature**
Keine / None
Course: Warehousing and Distribution Systems [T-MACH-105174]

**Responsible:** Prof. Dr.-Ing. Kai Furmans

**Organisation:** KIT Department of Mechanical Engineering

**Type**
- Written examination

**Credits**
- 3

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 2

**Events**

<table>
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<th>Credits</th>
<th>Type</th>
<th>Grading scale</th>
<th>Recurrence</th>
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<tbody>
<tr>
<td>ST 2024</td>
<td>3</td>
<td>2 SWS</td>
<td>Lecture / On-Site</td>
<td>Each summer term</td>
<td>2</td>
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Legend: ✓ Online, Blended (On-Site/Online), On-Site, ✗ Cancelled

**Competence Certificate**
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

**Prerequisites**

none

**Below you will find excerpts from events related to this course:**

**Warehousing and distribution systems**

2118097, SS 2024, 2 SWS, Language: German, [Open in study portal](#)

**Organizational issues**
Die Vorlesung wird in diesem Semester als Blockveranstaltung angeboten. Die Veranstaltungstermine sind:

- Mi., 24. April
- Do., 25. April
- Fr., 26. April

Die Vorlesung startet jeweils um 08:00 Uhr und findet im Selmayr-HS (Geb. 50.38) statt. Bitte beachten Sie für mögliche kurzfristige Raumänderungen die Informationen im ILIAS-Kurs.

**Literature**

- ARNOLD, Dieter, FURMANS, Kai (2005)
  Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag

- ARNOLD, Dieter (Hrsg.) et al. (2008)
  Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag

  Warehouse Science

- GUDEHUS, Timm (2005)
  Logistik, 3. Auflage, Berlin: Springer-Verlag

- FRAZELLE, Edward (2002)
  World-class warehousing and material handling, McGraw-Hill

- MARTIN, Heinrich (1999)
  Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg

- WISSER, Jens (2009)
  Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe: Universitätsverlag

Eine ausführliche Übersicht wissenschaftlicher Paper findet sich bei:

- ROODBERGEN, Kees Jan (2007)
  Warehouse Literature
3.401 Course: Water Distribution Systems [T-BGU-108486]

**Responsible:** Dr.-Ing. Peter Oberle
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences
**Part of:** M-MACH-105405 - Courses of the KIT Department of Civil Engineering, Geo and Environmental Sciences

<table>
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<tbody>
<tr>
<td>Oral examination</td>
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</tbody>
</table>

**Events**

| WT 23/24 | 6222905 | Water Distribution Systems | 4 SWS | Lecture / Practice ( / D) | Oberle |

**Exams**

| WT 23/24 | 8244108486 | Water Distribution Systems | Oberle |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
The accomplishment 'Project Report Water Distribution Systems' (T-BGU-108485) has to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-108485 - Project Report Water Distribution Systems must have been passed.

**Recommendation**
one

**Annotation**
one
### 3.402 Course: Welding Technology [T-MACH-105170]

**Responsible:** Dr. Majid Farajian  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<th>Recurrence</th>
<th>Version</th>
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<td>WT 23/24 2173571 Welding Technology 2 SWS Block / On-Site 20 minutes Farajian</td>
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**Exams**

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<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>WT 23/24 76-T-MACH-105170 Welding Technology 2 SWS Block / On-Site 20 minutes Farajian</td>
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</table>

**Legend:** 🖥 Online, ☑️ Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

**Recommendation**

Basics of material science (iron- and non-iron alloys), materials, processes and production, design.

All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

**Below you will find excerpts from events related to this course:**

<table>
<thead>
<tr>
<th>Welding Technology</th>
<th>2173571, WS 23/24, 2 SWS, Language: German, Open in study portal</th>
</tr>
</thead>
</table>
|                     | 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
Blockveranstaltung im Januar und Februar. Zur Teilnahme an der Vorlesung ist eine Anmeldung beim Dozenten per E-Mail an Farajian@slv-duisburg.de erforderlich. Vorlesungstermine und Hörsaal werden den angemeldeten Teilnehmern Anfang des Jahres mitgeteilt.

Literature
Für ergänzende, vertiefende Studien gibt das
Handbuch der Schweiflchnik 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 Schweiflchnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweifverfahren bietet das Bändchen
Nies: Lichtbogenschweiftechnik, 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 Fügetchnik verwiesen.
**T 3.403 Course: Wildcard [T-MACH-112696]**

**Organisation:**  KIT Department of Mechanical Engineering  
**Part of:**  M-MACH-106251 - Courses of the KIT Department of Architecture  

<table>
<thead>
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<td>Each term</td>
<td>1</td>
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</table>

KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)  
Module Handbook as of 23/02/2024
## 3.404 Course: Wildcard [T-MACH-112700]

**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106253 - Courses of the KIT Department of Humanities and Social Sciences

<table>
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<td>Each term</td>
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</tbody>
</table>
### 3.405 Course: Wildcard [T-MACH-112697]

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106251 - Courses of the KIT Department of Architecture

<table>
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<td>pass/fail</td>
<td>Each term</td>
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</tbody>
</table>
Course: Wildcard [T-MACH-112698]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

<table>
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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each term</td>
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</table>
### 3.407 Course: Wildcard [T-MACH-112703]

**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106254 - Courses of the KIT Department of Physics

<table>
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<td>pass/fail</td>
<td>Each term</td>
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</table>
3.408 Course: Wildcard [T-MACH-112699]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106252 - Courses of the KIT Department of Chemistry and Biosciences

<table>
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<td>pass/fail</td>
<td>Each term</td>
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</tbody>
</table>
# 3.409 Course: Wildcard [T-MACH-112701]

**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-106253 - Courses of the KIT Department of Humanities and Social Sciences

<table>
<thead>
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3.410 Course: Wildcard [T-MACH-112702]

Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106254 - Courses of the KIT Department of Physics

<table>
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<tr>
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<th>Credits</th>
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<th>Version</th>
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<tbody>
<tr>
<td>Examination of another type</td>
<td>15</td>
<td>Grade to a third</td>
<td>Each term</td>
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</table>
3.411 Course: Windpower [T-MACH-105234]

- **Responsible:** Norbert Lewald
- **Organisation:** KIT Department of Mechanical Engineering
- **Institute of Thermal Turbomachinery**
- **Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
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<td>Written examination</td>
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<td>Each winter term</td>
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**Events**

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<th>Type</th>
<th>Exam Code</th>
<th>Exam Title</th>
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<tbody>
<tr>
<td>WT 23/24 2157381</td>
<td>2 SWS</td>
<td>Windpower</td>
<td>/ 🗣</td>
<td>Lewald</td>
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**Exams**

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<tbody>
<tr>
<td>WT 23/24 76-T-MACH-105234</td>
<td></td>
<td>Windpower</td>
<td></td>
<td>Lewald</td>
<td></td>
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<tr>
<td>ST 2024 76-T-MACH-105234</td>
<td></td>
<td>Windpower</td>
<td></td>
<td>Lewald</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗣 On-Site
- ✗ Cancelled

**Competence Certificate**

written exam, 120 minutes

**Prerequisites**

none

*Below you will find excerpts from events related to this course:*

**Windpower**

2157381, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)
### Course: Working Methods in Materials Science and Technology [T-MACH-100288]

<table>
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<td>pass/fail</td>
<td>Each term</td>
<td>1</td>
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**Responsible:** Prof. Dr.-Ing. Martin Heilmaier

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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KIT Department of Mechanical Engineering - Non-degree Studies (Domestic Degree at Another Higher Education Institution)
Module Handbook as of 23/02/2024
3.413 Course: Workshop Mechatronical Systems and Products [T-MACH-108680]

**Responsible:** Prof. Dr.-Ing. Sören Hohmann  
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

| WT 23/24 | 2145162 | Workshop Mechatronical Systems and Products | 2 SWS | Practical course / 🗣 | Teltschik, Matthiesen, Hohmann |

| Exams     | 76-T-MACH-108680 | Workshop Mechatronical Systems and Products | Hohmann, Matthiesen |

**Competence Certificate**

Alongside the workshop, deliverables will be requested at defined milestones. In these, the application of the knowledge that has been developed within the framework of the module will be examined. These deliverables consist of CAD designs, control software and reflection reports, for example, are defined in a workshop assignment at the beginning of the semester. The milestones are announced in a calendar at the beginning of the semester and are available to students through ILIAS. The demanded deliveries are uploaded to ILIAS.

**Prerequisites**

none

**Annotation**

All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey "Anmeldung und Gruppeneinteilung" in ILIAS before the start of the semester.
### 3.414 Course: Workshop on Computer-based Flow Measurement Techniques [T-MACH-106707]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Institute of Thermal Turbomachinery**  
**Part of:** M-MACH-106250 - Courses of the KIT Department of Mechanical Engineering

<table>
<thead>
<tr>
<th>Type</th>
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<td></td>
<td></td>
<td>pass/fail</td>
<td>Each term</td>
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#### Events

| WT 23/24 | 2171488 | Workshop on computer-based flow measurement techniques | 3 SWS | Practical course / 🗣 | Bauer, Mitarbeiter |
| ST 2024  | 2171488 | Workshop on computer-based flow measurement techniques | 3 SWS | Practical course / 🗣 | Bauer, Mitarbeiter |

#### Exams

| WT 23/24 | 76-T-MACH-106707 | Workshop on computer-based flow measurement techniques | Bauer |

*Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled*

**Competence Certificate**  
Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

**Prerequisites**

none

*Below you will find excerpts from events related to this course:*

**Workshop on computer-based flow measurement techniques**  
2171488, WS 23/24, 3 SWS, Language: German, Open in study portal

**Practical course (P)**  
**On-Site**
Content
Registration during the lecture period via the website.

The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.

Basic design of measurements systems
- Logging devices and sensors
- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- Frequency analysis

regular attendance: 52,5
self-study: 67,5

The students are able to:
- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC exercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Organizational issues
Der aktuelle Status wird auf der ITS-homepage bekannt gegeben.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985
LabView User Manual
Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl., 2011

Workshop on computer-based flow measurement techniques
2171488, SS 2024, 3 SWS, Language: German, Open in study portal

Practical course (P)
On-Site
Content
Registration during the lecture period via the website.

The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.

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