

Module Handbook

Bioengineering Master 2016 (Master of Science (M.Sc.))

SPO 2016

Summer term 2025

Date: 08/04/2025

KIT DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

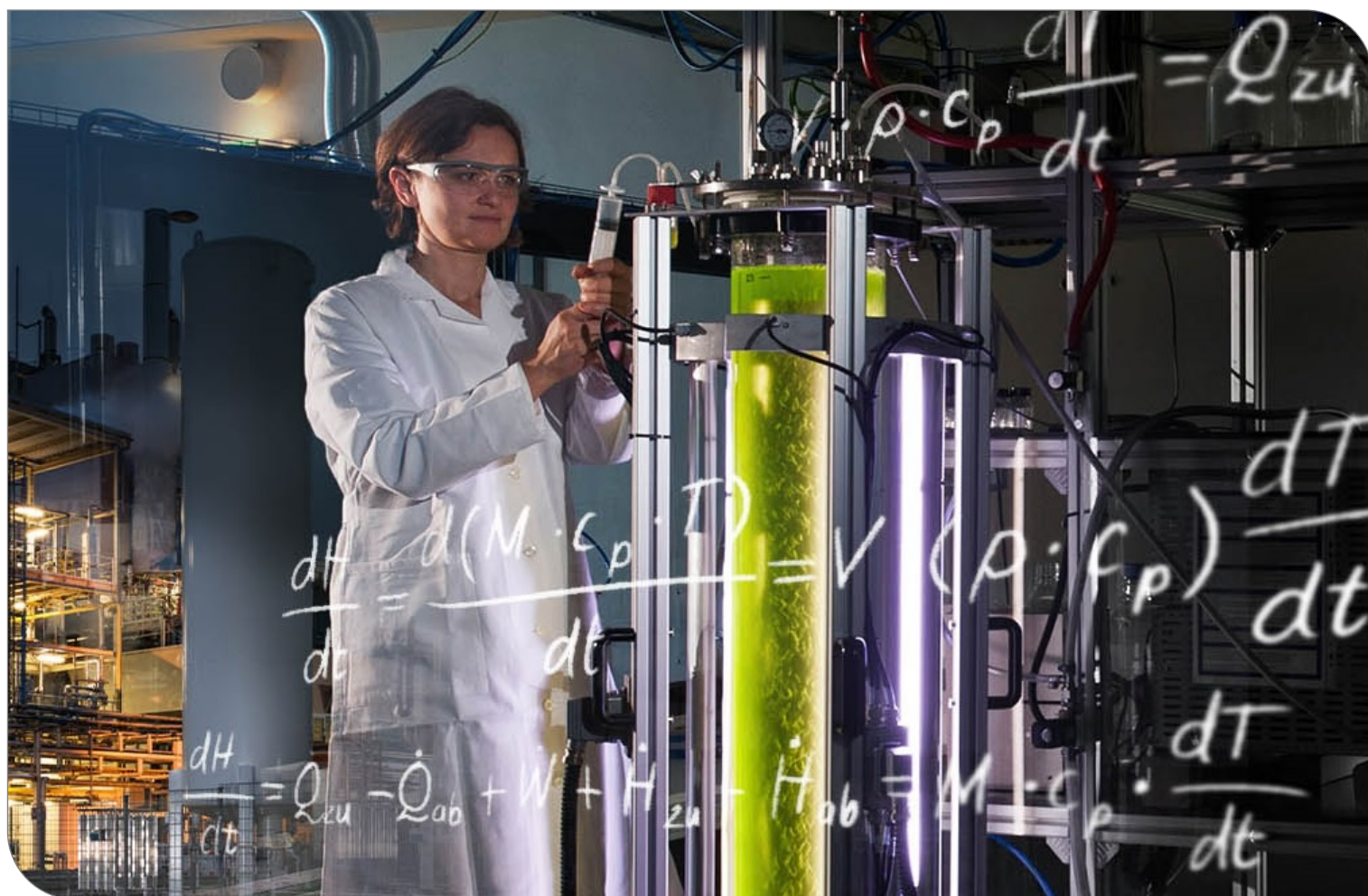


Table Of Contents

| | |
|--|-----------|
| 1. General Information | 9 |
| 1.1. Study program details | 9 |
| 1.2. Qualification Goals | 9 |
| 1.3. Studies and Examination Regulations | 9 |
| 1.4. Organizational issues | 10 |
| 2. English Courses | 11 |
| 3. New in summer 2025 | 12 |
| 4. Curriculum | 14 |
| 5. Field of study structure | 16 |
| 5.1. Master's Thesis | 16 |
| 5.2. Advanced Fundamentals | 16 |
| 5.3. Technical Supplement Course | 17 |
| 5.4. Specialized Course I | 22 |
| 5.4.1. Applied Rheology | 23 |
| 5.4.2. Automation and Process Systems Engineering | 24 |
| 5.4.3. Biopharmaceutical Process Engineering | 25 |
| 5.4.4. Fuel Technology | 26 |
| 5.4.5. Chemical Process Engineering | 27 |
| 5.4.6. Energy Process Engineering | 28 |
| 5.4.7. Entrepreneurship in Process Engineering | 28 |
| 5.4.8. Gas Particle Systems | 29 |
| 5.4.9. Food Process Engineering | 30 |
| 5.4.10. New Bio-Production Systems - Electro-Biotechnology | 31 |
| 5.4.11. Bioresource Engineering | 32 |
| 5.4.12. Mechanical Process Engineering | 33 |
| 5.4.13. Technical Thermodynamics | 35 |
| 5.4.14. Thermal Process Engineering | 36 |
| 5.4.15. Environmental Process Engineering | 37 |
| 5.4.16. Combustion Technology | 37 |
| 5.4.17. Water Technology | 38 |
| 5.5. Internship | 38 |
| 5.6. Additional Examinations | 38 |
| 6. Modules | 39 |
| 6.1. Model Development and Simulation in Thermal Process Engineering - M-CIWVT-106832 | 39 |
| 6.2. Additive Manufacturing for Process Engineering - M-CIWVT-105407 | 40 |
| 6.3. Advanced Methods in Nonlinear Process Control - M-CIWVT-106715 | 41 |
| 6.4. Air Pollution Control - Laws, Technology and Application - M-CIWVT-106314 | 42 |
| 6.5. Alternative Protein Technologies - M-CIWVT-106661 | 43 |
| 6.6. Applied Mass Transfer - Energy Systems and Thin Films - M-CIWVT-106823 | 44 |
| 6.7. Batteries and Fuel Cells - M-ETIT-100532 | 45 |
| 6.8. Battery and Fuel Cells Systems - M-ETIT-100377 | 46 |
| 6.9. Biobased Plastics - M-CIWVT-104570 | 47 |
| 6.10. Biofilm Systems - M-CIWVT-103441 | 48 |
| 6.11. Biomass Based Energy Carriers - M-CIWVT-104288 | 49 |
| 6.12. BioMEMS - Microsystems Technologies for Life Sciences and Medicine I - M-MACH-100489 | 50 |
| 6.13. BioMEMS - Microsystems Technologies for Life Sciences and Medicine II - M-MACH-100490 | 51 |
| 6.14. BioMEMS - Microsystems Technologies for Life Sciences and Medicine III - M-MACH-100491 | 52 |
| 6.15. Biopharmaceutical Purification Processes - M-CIWVT-103065 | 53 |
| 6.16. Bioprocess Development - M-CIWVT-106297 | 54 |
| 6.17. Bioprocess Scale-up - M-CIWVT-106837 | 56 |
| 6.18. Bioreactor Development - M-CIWVT-106595 | 57 |
| 6.19. Biosensors - M-CIWVT-106838 | 58 |
| 6.20. Biotechnological Production - M-CIWVT-104384 | 59 |
| 6.21. Biotechnological Use of Renewable Resources - M-CIWVT-105295 | 60 |
| 6.22. C1-Biotechnology - M-CIWVT-106816 | 61 |
| 6.23. Catalysis for Sustainable Chemicals and Energies - M-CIWVT-107131 | 62 |

| | |
|--|-----|
| 6.24. Catalytic Micro Reactors - M-CIWVT-104451 | 63 |
| 6.25. Catalytic Micro Reactors (including practical course) - M-CIWVT-104491 | 64 |
| 6.26. Catalytic Processes in Gas Technologies - M-CIWVT-104287 | 65 |
| 6.27. Chemical Hydrogen Storage - M-CIWVT-106566 | 66 |
| 6.28. Chemical Process Engineering II - M-CIWVT-104281 | 67 |
| 6.29. Chem-Plant - M-CIWVT-104461 | 68 |
| 6.30. Circular Economy - M-CIWVT-106881 | 69 |
| 6.31. Combustion and Environment - M-CIWVT-104295 | 70 |
| 6.32. Combustion Technology - M-CIWVT-103069 | 71 |
| 6.33. Commercial Biotechnology - M-CIWVT-104273 | 73 |
| 6.34. Computational Fluid Dynamics - M-CIWVT-103072 | 74 |
| 6.35. Computational Fluid Dynamics and Simulation Lab - M-MATH-106634 | 75 |
| 6.36. Computer-Aided Reactor Design - M-CIWVT-106809 | 76 |
| 6.37. Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids - M-CIWVT-104328 | 77 |
| 6.38. Control of Distributed Parameter Systems - M-CIWVT-106318 | 78 |
| 6.39. Cryogenic Engineering - M-CIWVT-104356 | 79 |
| 6.40. Data Analysis and Statistics - M-CIWVT-104345 | 80 |
| 6.41. Data-Based Modeling and Control - M-CIWVT-106319 | 81 |
| 6.42. Data-Driven Process Engineering Models in Python - M-CIWVT-106835 | 82 |
| 6.43. Design of a Jet Engine Combustion Chamber - M-CIWVT-105206 | 83 |
| 6.44. Design of Micro Reactors - M-CIWVT-104286 | 84 |
| 6.45. Development of an Innovative Food Product - M-CIWVT-104388 | 85 |
| 6.46. Digital Design in Process Engineering - M-CIWVT-105782 | 86 |
| 6.47. Digitization in Particle Technology - M-CIWVT-104973 | 87 |
| 6.48. Dimensional Analysis of Fluid Mechanic Problems - M-CIWVT-104327 | 88 |
| 6.49. Drying Technology - M-CIWVT-104370 | 89 |
| 6.50. Dynamics of Process Engineering Systems - M-CIWVT-107037 | 90 |
| 6.51. Electrobiotechnology - M-CIWVT-106518 | 91 |
| 6.52. Electrocatalysis - M-ETIT-105883 | 92 |
| 6.53. Electrochemistry - M-CHEMBIO-106697 | 93 |
| 6.54. Energy Technology - M-CIWVT-104293 | 94 |
| 6.55. Engineering Heterogeneous Catalysis - M-CIWVT-107025 | 95 |
| 6.56. Environmental Biotechnology - M-CIWVT-104320 | 96 |
| 6.57. Estimator and Observer Design - M-CIWVT-106320 | 97 |
| 6.58. Extrusion Technology in Food Processing - M-CIWVT-105996 | 98 |
| 6.59. Flow and Combustion Instabilities in Technical Burner Systems - M-CIWVT-104294 | 99 |
| 6.60. Fluid Mechanics of Non Newtonian Fluids - M-CIWVT-104322 | 100 |
| 6.61. Fluidized Bed Technology - M-CIWVT-104292 | 101 |
| 6.62. Food Chemistry Basics - M-CHEMBIO-104620 | 102 |
| 6.63. Formulation of (Bio)pharmaceutical Therapeutics - M-CIWVT-104266 | 103 |
| 6.64. Fuel Technology - M-CIWVT-104289 | 104 |
| 6.65. Fundamentals of Water Quality - M-CIWVT-103438 | 105 |
| 6.66. Gas Particle Measurement Technology - M-CIWVT-104337 | 106 |
| 6.67. Gas Particle Separation Processes - M-CIWVT-104340 | 107 |
| 6.68. Heat Exchangers - M-CIWVT-104371 | 108 |
| 6.69. Heat Transfer II - M-CIWVT-103051 | 109 |
| 6.70. High Temperature Process Engineering - M-CIWVT-103075 | 110 |
| 6.71. Hydrogen and Fuel Cell Technologies - M-CIWVT-104296 | 111 |
| 6.72. Hydrogen in Materials – Exercises and Lab Course - M-MACH-107278 | 113 |
| 6.73. Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement - M-MACH-107277 | 114 |
| 6.74. Industrial Aspects in Bioprocess Technology - M-CIWVT-105412 | 115 |
| 6.75. Industrial Biocatalysis - M-CIWVT-106678 | 116 |
| 6.76. Industrial Bioprocesses - M-CIWVT-106501 | 117 |
| 6.77. Industrial Wastewater Treatment - M-CIWVT-105903 | 118 |
| 6.78. Innovation Management for Products & Processes in the Chemical Industry - M-CIWVT-104397 | 119 |
| 6.79. Innovative Concepts for Formulation and Processing of Printable Materials - M-CIWVT-105993 | 121 |
| 6.80. Internship - M-CIWVT-104527 | 122 |
| 6.81. Introduction to Numerical Simulation of Reacting Flows - M-CIWVT-106676 | 123 |
| 6.82. Introduction to Sensory Analysis - M-CIWVT-105933 | 124 |
| 6.83. Journal Club - Novel Bioproduction Systems - M-CIWVT-106526 | 125 |

| | |
|---|-----|
| 6.84. Kinetics and Catalysis - M-CIWVT-104383 | 126 |
| 6.85. Liquid Transportation Fuels - M-CIWVT-105200 | 127 |
| 6.86. Mass Transfer II - M-CIWVT-104369 | 128 |
| 6.87. Materials and Processes for Electrochemical Storage - M-CIWVT-104353 | 129 |
| 6.88. Measurement Techniques in Chemical Processing - M-CIWVT-104490 | 130 |
| 6.89. Measurement Techniques in Chemical Processing (including practical course) - M-CIWVT-104450 | 131 |
| 6.90. Measurement Techniques in the Thermo-Fluid Dynamics - M-CIWVT-104297 | 132 |
| 6.91. Membrane Materials & Processes Research Masterclass - M-CIWVT-106529 | 134 |
| 6.92. Membrane Technologies in Water Treatment - M-CIWVT-105380 | 135 |
| 6.93. Microbiology for Engineers - M-CIWVT-104319 | 137 |
| 6.94. Microfluidics - M-CIWVT-104350 | 138 |
| 6.95. Microfluidics and Case Studies - M-CIWVT-105205 | 139 |
| 6.96. Microrheology and High Frequency Rheology - M-CIWVT-104395 | 140 |
| 6.97. Mixing, Stirring, Agglomeration - M-CIWVT-105399 | 141 |
| 6.98. Modeling Wastewater Treatment Processes - M-BGU-106113 | 142 |
| 6.99. Modelling and Simulation of Electrochemical Systems - M-ETIT-100508 | 144 |
| 6.100. Modern Concepts in Catalysis: From Science to Engineering - M-CIWVT-107149 | 145 |
| 6.101. Module Master's Thesis - M-CIWVT-104526 | 146 |
| 6.102. Molecular Biology and Genetics - M-CHEMBIO-106204 | 147 |
| 6.103. Nanoparticles – Structure and Function - M-CIWVT-104339 | 148 |
| 6.104. NMR for Engineers - M-CIWVT-104401 | 149 |
| 6.105. NMR Methods for Product and Process Analysis - M-CIWVT-105890 | 150 |
| 6.106. Nonlinear Process Control - M-CIWVT-106316 | 151 |
| 6.107. Numerical Methods in Fluid Mechanics - M-MATH-102932 | 152 |
| 6.108. Numerical Simulation of Reacting Multiphase Flows - M-CIWVT-106565 | 153 |
| 6.109. Numerical Simulation of Reacting Multiphase Flows - M-CIWVT-107076 | 154 |
| 6.110. Optimal and Model Predictive Control - M-CIWVT-106317 | 156 |
| 6.111. Organ Support Systems - M-MACH-102702 | 157 |
| 6.112. Parallel Computing - M-MATH-101338 | 158 |
| 6.113. Particle Technology - M-CIWVT-104378 | 159 |
| 6.114. Physical Foundations of Cryogenics - M-CIWVT-103068 | 160 |
| 6.115. Polymer Thermodynamics - M-CIWVT-106882 | 161 |
| 6.116. Power-to-X – Key Technology for the Energy Transition - M-CIWVT-105891 | 162 |
| 6.117. Practical Course Combustion Technology - M-CIWVT-104321 | 164 |
| 6.118. Practical Course in Water Technology - M-CIWVT-103440 | 165 |
| 6.119. Principles of Ceramic and Powder Metallurgy Processing - M-CIWVT-104886 | 167 |
| 6.120. Principles of Constrained Static Optimization - M-CIWVT-106313 | 168 |
| 6.121. Principles of Medicine for Engineers - M-MACH-102720 | 169 |
| 6.122. Process Analysis: Modeling, Data Mining, Machine Learning - M-ETIT-105594 | 170 |
| 6.123. Process and Plant Safety - M-CIWVT-104352 | 171 |
| 6.124. Process Development in the Chemical Industry - M-CIWVT-104389 | 172 |
| 6.125. Process Engineering for the Production of Food from Animal Origins - M-CIWVT-106699 | 173 |
| 6.126. Process Engineering for the Production of Food from Plant-Based Raw Materials - M-CIWVT-106698 | 174 |
| 6.127. Process Engineering in Wastewater Treatment - M-BGU-103399 | 175 |
| 6.128. Process Instruments and Machinery and Their Process Integration - M-CIWVT-104351 | 177 |
| 6.129. Process Modeling in Downstream Processing - M-CIWVT-103066 | 178 |
| 6.130. Process Technology - M-CIWVT-104374 | 179 |
| 6.131. Processes and Process Chains for Renewable Resources - M-CIWVT-104422 | 180 |
| 6.132. Processing of Nanostructured Particles - M-CIWVT-103073 | 181 |
| 6.133. Product Development – Methods of Product Engineering - M-MACH-102718 | 182 |
| 6.134. Production and Development of Cancer Therapeutics - M-CIWVT-106563 | 184 |
| 6.135. Reaction Kinetics - M-CIWVT-104283 | 185 |
| 6.136. Reactor Modeling with CFD - M-CIWVT-106537 | 186 |
| 6.137. Refinery Technology - Liquid Fuels - M-CIWVT-104291 | 187 |
| 6.138. Refrigeration B - Foundations of Industrial Gas Processing - M-CIWVT-104354 | 188 |
| 6.139. Rheology and Processing of Disperse Systems - M-CIWVT-104336 | 189 |
| 6.140. Rheology and Processing of Polymers - M-CIWVT-104335 | 190 |
| 6.141. Rheology and Rheometry - M-CIWVT-104326 | 191 |
| 6.142. Rheology of Complex Fluids and Advanced Rheometry - M-CIWVT-104331 | 192 |
| 6.143. Rheology of Disperse Systems - M-CIWVT-104391 | 193 |

| | |
|--|------------|
| 6.144. Rheology of Polymers - M-CIWVT-104329 | 194 |
| 6.145. Seminar - M-MATH-103276 | 195 |
| 6.146. Seminar of Food Processing in Practice - M-CIWVT-105932 | 196 |
| 6.147. Simulation Technologies - M-CIWVT-107038 | 197 |
| 6.148. Single-Cell Technologies - M-CIWVT-106564 | 198 |
| 6.149. Sol-Gel Processes - M-CIWVT-104489 | 200 |
| 6.150. Sol-Gel-Processes (Including Practical Course) - M-CIWVT-104284 | 201 |
| 6.151. Solid Liquid Separation - M-CIWVT-104342 | 202 |
| 6.152. Stability of Disperse Systems - M-CIWVT-104330 | 203 |
| 6.153. Statistical Thermodynamics - M-CIWVT-103059 | 204 |
| 6.154. Students Innovation Lab - M-CIWVT-106017 | 205 |
| 6.155. Supplementary Studies on Science, Technology and Society - M-FORUM-106753 | 207 |
| 6.156. Thermal Process Engineering II - M-CIWVT-107039 | 211 |
| 6.157. Thermal Process Engineering III - M-CIWVT-107040 | 212 |
| 6.158. Thermodynamics III - M-CIWVT-103058 | 213 |
| 6.159. Thermodynamics of Interfaces - M-CIWVT-103063 | 214 |
| 6.160. Vacuum Technology - M-CIWVT-104478 | 215 |
| 6.161. Wastewater Treatment Technologies - M-BGU-104917 | 216 |
| 6.162. Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation - M-CIWVT-106680 | 218 |
| 6.163. Water Technology - M-CIWVT-103407 | 219 |
| 7. Courses..... | 220 |
| 7.1. Model Development and Simulation in Thermal Process Engineering - T-CIWVT-113702 | 220 |
| 7.2. Additive Manufacturing for Process Engineering - Examination - T-CIWVT-110902 | 221 |
| 7.3. Advanced Methods in Nonlinear Process Control - T-CIWVT-113490 | 222 |
| 7.4. Air Pollution Control - Laws, Technology and Application - T-CIWVT-112812 | 223 |
| 7.5. Alternative Protein Technologies - T-CIWVT-113429 | 224 |
| 7.6. Applied Mass Transfer - Energy Systems and Thin Films - T-CIWVT-113692 | 225 |
| 7.7. Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113579 | 226 |
| 7.8. Batteries and Fuel Cells - T-ETIT-100983 | 227 |
| 7.9. Battery and Fuel Cells Systems - T-ETIT-100704 | 228 |
| 7.10. Biobased Plastics - T-CIWVT-109369 | 229 |
| 7.11. Biofilm Systems - T-CIWVT-106841 | 230 |
| 7.12. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I - T-MACH-100966 | 231 |
| 7.13. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II - T-MACH-100967 | 232 |
| 7.14. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III - T-MACH-100968 | 233 |
| 7.15. Biopharmaceutical Purification Processes - T-CIWVT-106029 | 234 |
| 7.16. Bioprocess Development - T-CIWVT-112766 | 235 |
| 7.17. Bioprocess Scale-up - T-CIWVT-113712 | 236 |
| 7.18. Bioreactor Development - T-CIWVT-113315 | 237 |
| 7.19. Biosensors - T-CIWVT-113714 | 238 |
| 7.20. Biotechnological Production - T-CIWVT-113831 | 239 |
| 7.21. Biotechnological Use of Renewable Resources - T-CIWVT-113237 | 240 |
| 7.22. C1-Biotechnology Exam - T-CIWVT-113677 | 241 |
| 7.23. C1-Biotechnology Presentation - T-CIWVT-113678 | 242 |
| 7.24. Catalysis for Sustainable Chemicals and Energies - T-CIWVT-114167 | 243 |
| 7.25. Catalytic Micro Reactors - T-CIWVT-109087 | 244 |
| 7.26. Catalytic Processes in Gas Technologies - T-CIWVT-108827 | 245 |
| 7.27. Chemical Hydrogen Storage - T-CIWVT-113234 | 246 |
| 7.28. Chemical Process Engineering II - T-CIWVT-108817 | 247 |
| 7.29. Chem-Plant - T-CIWVT-109127 | 248 |
| 7.30. Circular Economy - T-CIWVT-113815 | 249 |
| 7.31. Combustion and Environment - T-CIWVT-108835 | 250 |
| 7.32. Combustion Technology - T-CIWVT-106104 | 251 |
| 7.33. Commercial Biotechnology - T-CIWVT-108811 | 252 |
| 7.34. Computational Fluid Dynamics - T-CIWVT-106035 | 253 |
| 7.35. Computational Fluid Dynamics and Simulation Lab - T-MATH-113373 | 254 |
| 7.36. Computer-Aided Reactor Design - T-CIWVT-113667 | 255 |
| 7.37. Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids - T-CIWVT-108883 | 256 |
| 7.38. Control of Distributed Parameter Systems - T-CIWVT-112826 | 257 |
| 7.39. Cryogenic Engineering - T-CIWVT-108915 | 258 |

| | |
|---|-----|
| 7.40. Data Analysis and Statistics - T-CIWVT-108900 | 259 |
| 7.41. Data-Based Modeling and Control - T-CIWVT-112827 | 260 |
| 7.42. Data-Driven Models in Python - Process Engineering Project - T-CIWVT-113708 | 261 |
| 7.43. Data-Driven Process Engineering Models in Python - Exam - T-CIWVT-113709 | 262 |
| 7.44. Design of a Jet Engine Combustion Chamber - T-CIWVT-110571 | 263 |
| 7.45. Design of Micro Reactors - T-CIWVT-108826 | 264 |
| 7.46. Development of an Innovative Food Product - T-CIWVT-108960 | 265 |
| 7.47. Development of an Innovative Food Product - presentation - T-CIWVT-111010 | 266 |
| 7.48. Digital Design in Process Engineering - Laboratory - T-CIWVT-111582 | 267 |
| 7.49. Digital Design in Process Engineering - Oral Examination - T-CIWVT-111583 | 268 |
| 7.50. Digitization in Particle Technology - T-CIWVT-110111 | 269 |
| 7.51. Dimensional Analysis of Fluid Mechanic Problems - T-CIWVT-108882 | 270 |
| 7.52. Drying Technology - T-CIWVT-108936 | 271 |
| 7.53. Dynamics of Process Engineering Systems - Exam - T-CIWVT-114106 | 272 |
| 7.54. Dynamics Process Engineering Systems - Prerequisite - T-CIWVT-114105 | 273 |
| 7.55. Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration - T-FORUM-113580 | 274 |
| 7.56. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration - T-FORUM-113582 | 275 |
| 7.57. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration - T-FORUM-113581 | 276 |
| 7.58. Electrobiotechnology - T-CIWVT-113148 | 277 |
| 7.59. Electrobiotechnology Seminar - T-CIWVT-113829 | 278 |
| 7.60. Electrocatalysis - T-ETIT-111831 | 279 |
| 7.61. Electrochemistry - T-CHEMBIO-109773 | 280 |
| 7.62. Energy from Biomass - T-CIWVT-108828 | 281 |
| 7.63. Energy Technology - T-CIWVT-108833 | 282 |
| 7.64. Engineering Heterogeneous Catalysis - T-CIWVT-114085 | 283 |
| 7.65. Entrepreneurship - T-WIWI-102864 | 284 |
| 7.66. Environmental Biotechnology - T-CIWVT-106835 | 285 |
| 7.67. Estimator and Observer Design - T-CIWVT-112828 | 286 |
| 7.68. Exercises: Membrane Technologies - T-CIWVT-113235 | 287 |
| 7.69. Excursions: Water Supply - T-CIWVT-110866 | 288 |
| 7.70. Extrusion Technology in Food Processing - T-CIWVT-112174 | 289 |
| 7.71. Flow and Combustion Instabilities in Technical Burner Systems - T-CIWVT-108834 | 290 |
| 7.72. Fluid Mechanics of Non-Newtonian Fluids - T-CIWVT-108874 | 291 |
| 7.73. Fluidized Bed Technology - T-CIWVT-108832 | 292 |
| 7.74. Food Chemistry Basics - T-CHEMBIO-109442 | 293 |
| 7.75. Formulation of (Bio)pharmaceutical Therapeutics - T-CIWVT-108805 | 294 |
| 7.76. Fuel Technology - T-CIWVT-108829 | 295 |
| 7.77. Fundamentals of Water Quality - T-CIWVT-106838 | 296 |
| 7.78. Gas Particle Measurement Technology - T-CIWVT-108892 | 297 |
| 7.79. Gas Particle Separation Processes - T-CIWVT-108895 | 298 |
| 7.80. Heat Exchangers - T-CIWVT-108937 | 299 |
| 7.81. Heat Transfer II - T-CIWVT-106067 | 300 |
| 7.82. High Temperature Process Engineering - T-CIWVT-106109 | 301 |
| 7.83. Hydrogen and Fuel Cell Technologies - T-CIWVT-108836 | 302 |
| 7.84. Hydrogen in Materials – Exercises and Lab Course - T-MACH-112159 | 303 |
| 7.85. Hydrogen in Materials – Exercises and Lab Course - T-MACH-112942 | 304 |
| 7.86. Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement - T-MACH-110957 | 305 |
| 7.87. Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement - T-MACH-110923 | 306 |
| 7.88. Industrial Aspects in Bioprocess Technology - T-CIWVT-110935 | 307 |
| 7.89. Industrial Biocatalysis - T-CIWVT-113432 | 308 |
| 7.90. Industrial Bioprocesses - T-CIWVT-113120 | 309 |
| 7.91. Industrial Wastewater Treatment - T-CIWVT-111861 | 310 |
| 7.92. Initial Exam Process Technology and Plant Design - T-CIWVT-106149 | 311 |
| 7.93. Innovation Management for Products & Processes in the Chemical Industry - T-CIWVT-108980 | 312 |
| 7.94. Innovation Project Electronic Devices from Printable Conductive Materials - T-CIWVT-113226 | 313 |
| 7.95. Innovation Project Porous Ceramics from the 3D Printer - T-CIWVT-112201 | 314 |
| 7.96. Innovative Concepts for Formulation and Processing of Printable Materials - T-CIWVT-112170 | 315 |

| | |
|---|-----|
| 7.97. Internship - T-CIWVT-109276 | 316 |
| 7.98. Introduction to Numerical Simulation of Reacting Flows - T-CIWVT-113436 | 317 |
| 7.99. Introduction to Numerical Simulation of Reacting Flows - Prerequisite - T-CIWVT-113435 | 318 |
| 7.100. Introduction to Sensory Analysis with Practice - T-CIWVT-109128 | 319 |
| 7.101. Journal Club - Novel Bioproduction Systems - T-CIWVT-113149 | 320 |
| 7.102. Kinetics and Catalysis - T-CIWVT-106032 | 321 |
| 7.103. Laboratory Work for NMR for Engineers - T-CIWVT-109144 | 322 |
| 7.104. Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113578 | 323 |
| 7.105. Liquid Transportation Fuels - T-CIWVT-111095 | 324 |
| 7.106. Mass Transfer II - T-CIWVT-108935 | 325 |
| 7.107. Master's Thesis - T-CIWVT-109275 | 326 |
| 7.108. Materials and Processes for Electrochemical Storage - T-CIWVT-108146 | 327 |
| 7.109. Measurement Techniques in Chemical Processing - T-CIWVT-109086 | 328 |
| 7.110. Measurement Techniques in the Thermo-Fluid Dynamics - T-CIWVT-108837 | 329 |
| 7.111. Membrane Materials & Processes Research Masterclass - T-CIWVT-113153 | 330 |
| 7.112. Membrane Technologies in Water Treatment - T-CIWVT-113236 | 331 |
| 7.113. Methods and Processes of PGE - Product Generation Engineering - T-MACH-109192 | 332 |
| 7.114. Microbiology for Engineers - T-CIWVT-106834 | 333 |
| 7.115. Microfluidics - T-CIWVT-108909 | 334 |
| 7.116. Microfluidics - Case Studies - T-CIWVT-110549 | 335 |
| 7.117. Microrheology and High Frequency Rheology - T-CIWVT-108977 | 336 |
| 7.118. Mixing, Stirring, Agglomeration - T-CIWVT-110895 | 337 |
| 7.119. Modeling Wastewater Treatment Processes - T-BGU-112371 | 338 |
| 7.120. Modelling and Simulation of Electrochemical Systems - T-ETIT-100781 | 339 |
| 7.121. Modern Concepts in Catalysis: From Science to Engineering - T-CIWVT-114168 | 340 |
| 7.122. Molecular Biology and Genetics - T-CHEMBIO-103675 | 341 |
| 7.123. Nanoparticles – Structure and Function - T-CIWVT-108894 | 342 |
| 7.124. NMR for Engineers - T-CIWVT-108984 | 343 |
| 7.125. NMR Methods for Product and Process Analysis - T-CIWVT-111843 | 344 |
| 7.126. Nonlinear Process Control - T-CIWVT-112824 | 345 |
| 7.127. Numerical Methods in Fluid Mechanics - T-MATH-105902 | 346 |
| 7.128. Numerical Simulation of Reacting Multiphase Flows - T-CIWVT-114118 | 347 |
| 7.129. Numerical Simulation of Reacting Multiphase Flows - T-CIWVT-113233 | 348 |
| 7.130. Numerical Simulation of Reacting Multiphase Flows - Prerequisite - T-CIWVT-114117 | 349 |
| 7.131. Numerical Simulation of Reacting Multiphase Flows - Prerequisite - T-CIWVT-113232 | 350 |
| 7.132. Optimal and Model Predictive Control - T-CIWVT-112825 | 351 |
| 7.133. Organ Support Systems - T-MACH-105228 | 352 |
| 7.134. Parallel Computing - T-MATH-102271 | 353 |
| 7.135. Particle Technology Exam - T-CIWVT-106028 | 354 |
| 7.136. Physical Foundations of Cryogenics - T-CIWVT-106103 | 355 |
| 7.137. Polymer Thermodynamics - T-CIWVT-113796 | 356 |
| 7.138. Power-to-X – Key Technology for the Energy Transition - T-CIWVT-111841 | 357 |
| 7.139. Practical Course Combustion Technology - T-CIWVT-108873 | 358 |
| 7.140. Practical Course in Water Technology - T-CIWVT-106840 | 359 |
| 7.141. Practical Course Measurement Techniques in Chemical Processing - T-CIWVT-109182 | 360 |
| 7.142. Practical Course Measurement Techniques in Chemical Processing - T-CIWVT-109181 | 361 |
| 7.143. Practical Course Process Technology and Plant Design - T-CIWVT-106148 | 362 |
| 7.144. Practical Course Sol-Gel Processes - T-CIWVT-108823 | 363 |
| 7.145. Practical in Additive Manufacturing for Process Engineering - T-CIWVT-110903 | 364 |
| 7.146. Practical in Power-to-X: Key Technology for the Energy Transition - T-CIWVT-111842 | 365 |
| 7.147. Principles of Ceramic and Powder Metallurgy Processing - T-MACH-102111 | 366 |
| 7.148. Principles of Constrained Static Optimization - T-CIWVT-112811 | 367 |
| 7.149. Principles of Medicine for Engineers - T-MACH-105235 | 368 |
| 7.150. Process Analysis: Modeling, Data Mining, Machine Learning - T-ETIT-111214 | 369 |
| 7.151. Process and Plant Safety - T-CIWVT-108912 | 370 |
| 7.152. Process Development in the Chemical Industry - T-CIWVT-108961 | 371 |
| 7.153. Process Engineering for the Production of Food from Animal Origins - T-CIWVT-113477 | 372 |
| 7.154. Process Engineering for the Production of Food from Plant-Based Raw Materials - T-CIWVT-113476 | 373 |
| 7.155. Process Engineering in Wastewater Treatment - T-BGU-106787 | 374 |

| | |
|--|-----|
| 7.156. Process Instruments and Machinery and Their Process Integration - T-CIWVT-108910 | 375 |
| 7.157. Process Modeling in Downstream Processing - T-CIWVT-106101 | 376 |
| 7.158. Process Technology and Plant Design Written Exam - T-CIWVT-106150 | 377 |
| 7.159. Processes and Process Chains for Renewable Resources - T-CIWVT-108997 | 378 |
| 7.160. Processing of Nanostructured Particles - T-CIWVT-106107 | 379 |
| 7.161. Production and Development of Cancer Therapeutics - T-CIWVT-113230 | 380 |
| 7.162. Reaction Kinetics - T-CIWVT-108821 | 381 |
| 7.163. Reactor Modeling with CFD - T-CIWVT-113224 | 382 |
| 7.164. Refinery Technology - Liquid Fuels - T-CIWVT-108831 | 383 |
| 7.165. Refrigeration B - Foundations of Industrial Gas Processing - T-CIWVT-108914 | 384 |
| 7.166. Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society - T- FORUM-113587 | 385 |
| 7.167. Rheology and Processing of Disperse Systems - T-CIWVT-108891 | 386 |
| 7.168. Rheology and Processing of Polymers - T-CIWVT-108890 | 387 |
| 7.169. Rheology and Rheometry - T-CIWVT-108881 | 388 |
| 7.170. Rheology of Complex Fluids and Advanced Rheometry - T-CIWVT-108886 | 389 |
| 7.171. Rheology of Disperse Systems - T-CIWVT-108963 | 390 |
| 7.172. Rheology of Polymers - T-CIWVT-108884 | 391 |
| 7.173. Seminar Biotechnological Production - T-CIWVT-113830 | 392 |
| 7.174. Seminar Mathematics - T-MATH-106541 | 393 |
| 7.175. Seminar of Food Processing in Practice with Excursion - T-CIWVT-109129 | 394 |
| 7.176. SIL Entrepreneurship Project - T-WIWI-110166 | 395 |
| 7.177. Simulation Technologies - Exam - T-CIWVT-114104 | 396 |
| 7.178. Simulation Technologies - Prerequisite - T-CIWVT-114141 | 397 |
| 7.179. Single-Cell Technologies - T-CIWVT-113231 | 398 |
| 7.180. Sol-Gel Processes - T-CIWVT-108822 | 399 |
| 7.181. Solid Liquid Separation - T-CIWVT-108897 | 400 |
| 7.182. Stability of Disperse Systems - T-CIWVT-108885 | 401 |
| 7.183. Statistical Thermodynamics - T-CIWVT-106098 | 402 |
| 7.184. Thermal Process Engineering II - T-CIWVT-114107 | 403 |
| 7.185. Thermal Process Engineering III - T-CIWVT-114108 | 404 |
| 7.186. Thermodynamics III - T-CIWVT-106033 | 405 |
| 7.187. Thermodynamics of Interfaces - T-CIWVT-106100 | 406 |
| 7.188. Vacuum Technology - T-CIWVT-109154 | 407 |
| 7.189. Wastewater Treatment Technologies - T-BGU-109948 | 408 |
| 7.190. Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation - T-CIWVT-113433 | 409 |
| 7.191. Water Technology - T-CIWVT-106802 | 410 |

1 General Information

1.1 Study program details

| | |
|--|---|
| KIT-Department | KIT Department of Chemical and Process Engineering |
| Academic Degree | Master of Science (M.Sc.) |
| Examination Regulations Version | 2016 |
| Regular terms | 4 terms |
| Maximum terms | 8 terms |
| Credits | 120 |
| Language | German, some courses in English |
| Grade calculation | Weighted average by credits |
| Additional Information | <p>Link to study program www.ciw.kit.edu</p> <p>Department https://www.ciw.kit.edu/1630.php</p> <p>Business unit Studium und Lehre https://www.sle.kit.edu/vorstudium/master-bioingenieurwesen.php</p> |

1.2 Qualification Goals

The focus of bioengineering is on process engineering in the context of an industrial, engineering-driven application of biological and biotechnological principles. In this way, bioengineering differs from natural sciences programs, biotechnology or molecular biotechnology, which deal primarily with the utilization of biological principles. Bioengineers make a crucial contribution to the development of interdisciplinary approaches for creating an energetically and materially sustainable, post-fossil economy.

The Master's program provides extensive detailed knowledge in engineering, mathematics and natural sciences, which enables graduates to apply process engineering principles to biological material systems. The Master's degree qualifies graduates to work scientifically and act responsibly within their professional activity and in the society.

Based on the Bachelor's program, the compulsory program in the first year focuses on advanced methodical and qualified fundamental knowledge with a main focus on biotechnological procedures and processes that make an industrial utilization of biological systems possible. This knowledge is further advanced within two specialized courses elected by the students. One of these specialized courses has to deal with aspects of biotechnological material systems.

In the scope of the Master's thesis, students prove their ability to work on a problem within their field of expertise independently and in a defined time frame using scientific methods that correspond to the current state of research. In addition, an internship provides insight into the fields of activity of an engineer.

Graduates are qualified to analyze and solve problems using scientific methods and to abstract and formulate complex problems. They are also able to develop new methods, processes and products. Graduates are qualified to combine knowledge from various professional areas and to familiarize themselves systematically with new tasks. They can reflect non-technical impacts of engineering activities and consider those impacts by acting responsibly.

1.3 Studies and Examination Regulations

The legal basis for the study program and the examinations is the „Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Bioingenieurwesen“

(Study and Examination Regulations of the Karlsruhe Institute of Technology (KIT) for the Master Course of Studies in Bioengineering)

dated 03 May 2016, amended on 24 February 2020.

https://www.sle.kit.edu/downloads/AmtlicheBekanntmachungen/2016_AB_032.pdf

1.4 Organizational issues

Recognition of achievements according to § 19 SPO

A request for recognition of courses that were completed

- At another university
- Abroad
- Outside the higher education system
- Within the scope of the master transfer account

can be submitted to the Master Examination Board within one semester. There, if necessary after consultation with the subject representative, it will be determined whether the performance is equivalent to a performance envisaged in the curriculum of the course of study and can be recognised. Achievements completed as part of a semester abroad can also be recognized at a later date.

If you have already completed a professional internship or practical semester, you can apply for recognition directly at the Internship Office.

Registration for examinations in the specialized courses/ in the technical supplement course

Before registering for module examinations in Specialized Courses subjects as well as in the Technical Supplement Course, a study plan must be submitted to the Master's Examination Board (Marion Gärtner) for approval. Only then are the modules added to the study schedule and online registration in the student portal is possible. For more information, see the faculty website at

<https://www.ciw.kit.edu/1619.php>

Subsequent changes to the study plan must also be requested from Marion Gärtner.

Additional achievements and interdisciplinary qualification

Additional credits and interdisciplinary qualifications cannot always be registered directly in the CAS system (e.g. some modules from another faculty). In any case, you must contact Marion Gärtner before the examination.

Exception:

interdisciplinary qualification at the House of Competence (HoC) or Language Centre (SPZ) or FORUM

If the Soft Skill Qualification is taken at the HoC or Language Centre or FORUM, then no certificate of approval is required for an examination achievement, as the achievements are automatically posted in the CAS system under "unallocated credits".

If you want to credit a performance that is listed under "unallocated credits", you have submit a form to the Masters Examination Board.

For forms, please refer to the website of the KIT Faculty of Chemical and Process Engineering <https://www.ciw.kit.edu/1619.php>

MODULE IN ENGLISCHER SPRACHE

(English Courses)

| | | |
|---|------|-------|
| • Additive Manufacturing for Process Engineering | 6 LP | SS |
| • Advanced Methods in Nonlinear Control | 4 LP | SS |
| • Alternative Protein Technologies | 4 LP | SS |
| • Biofilm Systems | 4 LP | SS |
| • Bioprocess Development | 6 LP | SS |
| • Bioprocess Scale-Up | 4 LP | WS |
| • Biosensors | 4 LP | SS/WS |
| • Chemical Hydrogen Storage | 4 LP | WS |
| • Circular Economy Water, Energy, Environment: Research Proposal Preparation | 5 LP | SS |
| • Computational Fluid Dynamics and Simulation Lab | 4 LP | SS |
| • Computer-Aided Reactor Design | 6 LP | WS |
| • Computer-Assisted Modeling and Control | 4 LP | SS |
| • Cryogenic Engineering | 6 LP | WS |
| • Data-Based Modeling and Control | 6 LP | WS |
| • Design of a Jet Engine Combustion Chamber | 6 LP | WS |
| • Digital Design in Process Engineering | 6 LP | WS |
| • Electrocatalysis | 6 LP | SS |
| • Energy from Biomass | 6 LP | WS |
| • Environmental Biotechnology | 4 LP | WS |
| • Estimator and Observer Design | 6 LP | WS |
| • Extrusion Technology in Food Processing | 4 LP | WS |
| • Fundamentals of Water Quality | 6 LP | WS |
| • Industrial Wastewater Treatment | 4 LP | SS |
| • Innovation Management for Products and Processes in the Chemical Industry | 4 LP | SS |
| • Innovative Concepts for Formulation and Processing of Printable Materials | 6 LP | WS |
| • Introduction to Numerical Simulation of Reacting Flows | 8 LP | WS |
| • Laboratory Work in Combustion Technology | 4 LP | SS |
| • Liquid Transportation Fuels | 6 LP | WS |
| • Membrane Materials & Processes Research Masterclass | 6 LP | WS |
| • Membrane Technologies in Water Treatment | 6 LP | SS |
| • Microbiology for Engineers | 4 LP | SS |
| • Modern Concepts in Catalysis: From Science to Engineering | 4 LP | SS |
| • Nonlinear Process Control | 6 LP | WS |
| • Numerical Methods in Fluidmechanics | 4 LP | SS |
| • Numerical Simulation of Reacting Multiphase Flows | 8 LP | SS |
| • Optimal and Model Predictive Control | 6 LP | SS |
| • Physical Foundations of Cryogenics | 6 LP | SS |
| • Power-to-X – Key Technology for the Energy Transition | 6 LP | SS/WS |
| • Practical Course in Water Technology | 4 LP | WS |
| • Principles of Constrained Static Optimization | 4 LP | WS |
| • Reactor Modeling with CFD | 4 LP | SS |
| • Single-Cell Technologies | 4 LP | WS |
| • Water Technology | 6 LP | WS |

Bachelor-Courses

| | | |
|--|------|----|
| • Catalysts for the Energy Transition | 5 LP | SS |
| • Electrochemical Energy Technologies | 5 LP | WS |
| • Laboratory Electrochemical Energy Technologies | 5 LP | SS |

ÄNDERUNGEN SOMMERSEMESTER 2025

Neue Module

- Heterogene Katalyse im Ingenieurwesen
Verantwortung: Wehinger; Umfang: 6 LP; Wählbar: VF Chemische Verfahrenstechnik
- Katalyse für nachhaltige chemische Produkte und Energieträger
Verantwortung: Wolf u. a.; Umfang 4 LP; Wählbar: Technisches Ergänzungsfach
- Modern Concepts in Catalysis: From Science to Engineering
Verantwortung: Wehinger u. a.; Umfang: 4 LP; Wählbar: Technisches Ergänzungsfach
- Molekularbiologie und Genetik (ab WS 25/26)
Verantwortung: Kämper, Requena-Sanchez; Umfang: 5 LP; Wählbar: Neue Bioproduktionssysteme – Elektrobiotechnologie, Technisches Ergänzungsfach
- Simulationstechnik
Verantwortung: Meurer; Umfang 6 LP;
Wählbar: VF Automatisierung und Systemverfahrenstechnik, Technisches Ergänzungsfach
- Thermische Verfahrenstechnik II
Verantwortung: Zeiner; Umfang: 6 LP; Wählbar: Erweiterte Grundlagen, Technisches Ergänzungsfach
- Thermische Verfahrenstechnik III (ab WS 25/26)
Verantwortung: Zeiner; Umfang: 6 LP;
Wählbar: VF Thermische Verfahrenstechnik; Technisches Ergänzungsfach
- Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung
Verantwortung: Pundt; Umfang: 4 LP; Wählbar: Technisches Ergänzungsfach
- Wasserstoff in Materialien - Übungen und Laborkurs
Verantwortung: Pundt; Umfang: 4 LP; Wählbar: Technisches Ergänzungsfach nur in Kombination mit „Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung“

Auslaufende Module

- Biologie und Biotechnologie mit Pilzen
Das Modul wird nicht mehr angeboten. Letzte Prüfungsmöglichkeit nach Absprache.
- Biotechnologische Stoffproduktion
Die Vorlesung wird nicht mehr angeboten. Alternativ kann ab dem WS 25/26 das Modul Prozess- und Anlagendesign in der Biotechnologie gewählt werden.
- Dimensionsanalyse strömungsmechanischer Fragestellungen
Die Vorlesung wird letztmalig Mal im Sommersemester 2025 angeboten. Letzte Prüfungsmöglichkeit ist der 30.09.2025.
- Industrielle Genetik
Das Modul wird nicht mehr angeboten. Letzte Prüfungsmöglichkeit nach Absprache.
- Kontinuumsmechanik und Strömungen nicht-Newtonscher Fluide
Die Vorlesung wird nicht mehr angeboten; Letzte Prüfungsmöglichkeit ist am 30.09.2025.
- Physikalische Chemie
Das Modul wird nicht mehr angeboten. Letzte Prüfungsmöglichkeit voraussichtlich im WS 25/26.
- Rheologie und Rheometrie
Die Vorlesung wird letztmalig im Sommersemester 2025 angeboten. Letzte Prüfungsmöglichkeit ist der 30.09.2025.
- Rheologie und Verfahrenstechnik von Polymeren
Das Modul wird nicht mehr angeboten. Letzte Prüfungsmöglichkeit ist der 30.09.2025.

Änderung der Wahlmöglichkeiten/ Änderungen von Modulen

- Biosensors
Das Modul wird ab sofort sowohl im Sommer- als auch im Wintersemester angeboten.
- Lebensmittelkunde und -funktionalität: Das Modul wird im Sommersemester 2025 nicht angeboten. Es ist noch unklar, ab wann das Modul wieder angeboten werden kann.
- Die Einschränkung im Vertiefungsfach LVT, dass nur eines der Module Extrusion Technology in Food Processing oder Alternative Protein Technologies gewählt werden kann, gilt nicht mehr.
- Das Modul Chemische Verfahrenstechnik II kann im Vertiefungsfach Chemische Energieträger und Brennstofftechnologie nicht mehr gewählt werden. Das Modul ist ausschließlich im Vertiefungsfach Chemische Verfahrenstechnik wählbar.
- Das Modul Entwicklung eines innovativen Lebensmittelprodukts kann ab sofort auch im Vertiefungsfach Lebensmittelverfahrenstechnik gewählt werden.
- Das Modul Numerische Simulation von reaktiven Mehrphasenströmungen wird ab sofort unter dem Titel Numerical Simulation of Reacting Multiphase Flows auf Englisch angeboten.
- Die Module Introduction to Numerical Simulation of Reacting Flows und Numerical Simulation of Reacting Multiphase Flows sind jetzt auch im VF Chemische Energieträger – Brennstofftechnologie wählbar.

Subject and module overview

| Subject | Module | Courses | Responsible | Credits |
|---|---|-------------------|-------------|---------|
| Advanced Fundamentals | Mandatory: Process Technology | Lecture/ Exercise | Kolb | 8 |
| | | Praktikum | | |
| | Elective: 4 Modules/ 24 Credits from: | | | |
| | Biotechnological Production | Lecture | Holtmann | 6 |
| | | Seminar | | |
| | Biopharmaceutical Purification Processes | Lecture/ Exercise | Hubbuch | 6 |
| | Bioprocess Development | Lecture/ Exercise | Grünberger | 6 |
| | Membrane Technologies in Water Treatment | Lecture/ Exercise | Horn | 6 |
| | Alternatively: Maximum 2 elective modules from the Advanced Fundamentals of the Master's program Chemical and Process Engineering. | | | 6 |
| Study plan: Approval of the examination board required prior to registration for examinations in specialized courses and modules in the technical supplement courses! | | | | |
| Specialized Course I | 3 elective modules | | | 16 |
| Specialized Course II | 3 elective modules | | | 16 |
| Technical Supplement Course | 2 – 3 elective modules | | | 10 |
| Soft Skills | e. g. offers of the House of Competence | | | 2 |
| | Internship | | | 14 |
| | Master thesis | | | 30 |

The study program can be started in the summer semester as well as in the winter semester. In the first two semesters it is recommended to complete the modules of the subjects Advanced Fundamentals, Technical Supplement Course and Soft Skill Qualifications as well as to attend lectures in the Specialized Courses. The first half of the third semester is then used to prepare for the specialization examinations, some of which are offered as block examinations (all modules of a specialized course in one common date). Following the specialization examinations, the p internship can be completed. The master's thesis is written in the fourth semester.

[illegible]

| 1. Semester | | | | | | 2. Semester | | | | | | 3. Semester | | | | | | 4. Semester | | | | | |
|---|-----|------|------|--------|-----------|------------------------------|----------|----------|---------|----------|-------|---|-----|------|------|--------|-----------|-------------|----------|----------|---------|----------|-------|
| April | May | June | July | August | September | October | November | December | January | February | March | April | May | June | July | August | September | October | November | December | January | February | March |
| PAT Part II 3 CP | | | | | | PAT Part I 5 CP | | | | | | PrK | | | | | | | | | | | |
| WP I 6 CP | | | | | | WP I 6 CP | | | | | | K | | | | | | | | | | | |
| WP II 6 CP | | | | | | WP II 6 CP | | | | | | K | | | | | | | | | | | |
| TE 6 CP | | | | | | TE I 4 CP | | | | | | M | | | | | | | | | | | |
| VF I 4 CP | | | | | | VF I 4 CP | | | | | | P 8 CP | | | | | | | | | | | |
| VF II 4 CP | | | | | | VF II 4 CP | | | | | | P 8 CP | | | | | | | | | | | |
| ÜQ 2 CP | | | | | | | | | | | | Internship | | | | | | Thesis | | | | | |
| 31 CP | | | | | | 29 CP | | | | | | 30 CP | | | | | | 30 CP | | | | | |
| Number of graded exams: 4 | | | | | | Number of graded exams: 3 | | | | | | Number of graded exams: 6 | | | | | | | | | | | |
| Number of ungraded exams: | | | | | | Number of Labs (ungraded): 1 | | | | | | | | | | | | | | | | | |
| PAT: Process Technology (Advanced Fundamentals) | | | | | | | | | | | | K: Written Exam | | | | | | | | | | | |
| WP: Mandatory Elective (Advanced Fundamentals) | | | | | | | | | | | | M: Oral Exam | | | | | | | | | | | |
| TE: Technical Supplement Course | | | | | | | | | | | | S: Completed Coursework (ungraded) | | | | | | | | | | | |
| ÜQ: Interdisciplinary Qualifications | | | | | | | | | | | | Pr: Lab | | | | | | | | | | | |
| VF: Specialized Course | | | | | | | | | | | | P: Exam Preparation/ Oral Exam Specialized Course | | | | | | | | | | | |

5 Field of study structure

| | |
|--|-------|
| Mandatory | |
| Master's Thesis | 30 CR |
| Advanced Fundamentals | 32 CR |
| Technical Supplement Course | 10 CR |
| Specialized Course I | 16 CR |
| Internship | 14 CR |
| Voluntary | |
| Additional Examinations | |
| <i>This field will not influence the calculated grade of its parent.</i> | |

5.1 Master's Thesis

Credits
30

| | | |
|------------------|------------------------|-------|
| Mandatory | | |
| M-CIWVT-104526 | Module Master's Thesis | 30 CR |

5.2 Advanced Fundamentals

Credits
32

Election notes

Compulsory module:

- Process Technology (8 credits)

Compulsory elective modules:

- Four more modules of 6 credits each from the compulsory elective block "BIW"
- Alternatively: Up to two modules from the compulsory elective block "CIW"

| | | |
|---|--|------|
| Mandatory | | |
| M-CIWVT-104374 | Process Technology | 8 CR |
| BIW (Election: at least 2 items) | | |
| M-CIWVT-103065 | Biopharmaceutical Purification Processes | 6 CR |
| M-CIWVT-104384 | Biotechnological Production <i>First usage possible until Sep 30, 2025.</i> | 6 CR |
| M-CIWVT-105380 | Membrane Technologies in Water Treatment <i>First usage possible from Apr 01, 2021.</i> | 6 CR |
| M-CIWVT-106297 | Bioprocess Development <i>First usage possible from Apr 01, 2023.</i> | 6 CR |
| CIW (Election: at most 2 items) | | |
| M-CIWVT-103058 | Thermodynamics III | 6 CR |
| M-CIWVT-103072 | Computational Fluid Dynamics | 6 CR |
| M-CIWVT-104378 | Particle Technology | 6 CR |
| M-CIWVT-104383 | Kinetics and Catalysis | 6 CR |
| M-CIWVT-107039 | Thermal Process Engineering II <i>First usage possible from Apr 01, 2025.</i> | 6 CR |

5.3 Technical Supplement Course

Credits

10

Examinations

Learning control in all modules usually is an oral examination according to Section 4 Paragraph 2 no. 2 of the Studies and Examination Regulations of approx. 30 minutes. For information on the type of examination, please refer to the module descriptions.

Please note: Sometimes a different examination duration is indicated for modules of the specialized courses. Especially in specialized courses that are completed with a block examination of all modules, the examination duration for the individual modules is often shorter. In the Technical Supplement Course, the examination duration usually is 30 minutes!

Election notes

In the Technical Supplement Course two modules should be chosen. In addition to modules listed below, modules from other KIT Departments can also be taken after the approval of the Master Examination Board.

It is recommended to choose modules from specialized courses which are NOT part of the two selected specialized courses.

Election regulations

Elections in this field require confirmation.

| Technical Supplement Course (Election: at least 10 credits) | | |
|--|--|------|
| M-CIWVT-103051 | Heat Transfer II | 6 CR |
| M-CIWVT-103058 | Thermodynamics III | 6 CR |
| M-CIWVT-103059 | Statistical Thermodynamics | 6 CR |
| M-CIWVT-103063 | Thermodynamics of Interfaces | 4 CR |
| M-CIWVT-103065 | Biopharmaceutical Purification Processes | 6 CR |
| M-CIWVT-103066 | Process Modeling in Downstream Processing | 4 CR |
| M-CIWVT-103068 | Physical Foundations of Cryogenics | 6 CR |
| M-CIWVT-103069 | Combustion Technology | 6 CR |
| M-CIWVT-103072 | Computational Fluid Dynamics | 6 CR |
| M-CIWVT-103073 | Processing of Nanostructured Particles | 6 CR |
| M-CIWVT-103075 | High Temperature Process Engineering | 6 CR |
| M-CIWVT-103407 | Water Technology | 6 CR |
| M-CIWVT-103441 | Biofilm Systems | 4 CR |
| M-CIWVT-104266 | Formulation of (Bio)pharmaceutical Therapeutics | 4 CR |
| M-CIWVT-104273 | Commercial Biotechnology | 4 CR |
| M-CIWVT-104284 | Sol-Gel-Processes (Including Practical Course) | 6 CR |
| M-CIWVT-104286 | Design of Micro Reactors | 6 CR |
| M-CIWVT-104287 | Catalytic Processes in Gas Technologies | 4 CR |
| M-CIWVT-104288 | Biomass Based Energy Carriers | 6 CR |
| M-CIWVT-104289 | Fuel Technology | 6 CR |
| M-CIWVT-104291 | Refinery Technology - Liquid Fuels | 6 CR |
| M-CIWVT-104292 | Fluidized Bed Technology | 4 CR |
| M-CIWVT-104293 | Energy Technology | 4 CR |
| M-CIWVT-104294 | Flow and Combustion Instabilities in Technical Burner Systems | 4 CR |
| M-CIWVT-104295 | Combustion and Environment | 4 CR |
| M-CIWVT-104296 | Hydrogen and Fuel Cell Technologies | 4 CR |
| M-CIWVT-104297 | Measurement Techniques in the Thermo-Fluid Dynamics | 6 CR |
| M-CIWVT-105206 | Design of a Jet Engine Combustion Chamber <i>First usage possible from Oct 01, 2019.</i> | 6 CR |
| M-CIWVT-104319 | Microbiology for Engineers | 4 CR |
| M-CIWVT-104320 | Environmental Biotechnology | 4 CR |
| M-CIWVT-104321 | Practical Course Combustion Technology | 4 CR |
| M-CIWVT-104322 | Fluid Mechanics of Non Newtonian Fluids | 8 CR |
| M-CIWVT-104326 | Rheology and Rheometry <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104327 | Dimensional Analysis of Fluid Mechanic Problems <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104328 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104329 | Rheology of Polymers | 4 CR |
| M-CIWVT-104330 | Stability of Disperse Systems | 4 CR |
| M-CIWVT-104331 | Rheology of Complex Fluids and Advanced Rheometry | 4 CR |
| M-CIWVT-104335 | Rheology and Processing of Polymers <i>First usage possible until Sep 30, 2025.</i> | 8 CR |
| M-CIWVT-104336 | Rheology and Processing of Disperse Systems | 8 CR |
| M-CIWVT-104337 | Gas Particle Measurement Technology | 6 CR |
| M-CIWVT-104339 | Nanoparticles – Structure and Function | 6 CR |
| M-CIWVT-104340 | Gas Particle Separation Processes | 6 CR |
| M-CIWVT-104342 | Solid Liquid Separation | 8 CR |
| M-CIWVT-104345 | Data Analysis and Statistics | 4 CR |
| M-CIWVT-104350 | Microfluidics | 4 CR |
| M-CIWVT-104351 | Process Instruments and Machinery and Their Process Integration | 4 CR |

| | | |
|------------------|--|------|
| M-CIWVT-104352 | Process and Plant Safety | 4 CR |
| M-CIWVT-104353 | Materials and Processes for Electrochemical Storage | 4 CR |
| M-CIWVT-104354 | Refrigeration B - Foundations of Industrial Gas Processing | 6 CR |
| M-CIWVT-104356 | Cryogenic Engineering | 6 CR |
| M-CIWVT-104369 | Mass Transfer II | 6 CR |
| M-CIWVT-104370 | Drying Technology | 6 CR |
| M-CIWVT-104371 | Heat Exchangers | 4 CR |
| M-CIWVT-104374 | Process Technology | 8 CR |
| M-CIWVT-104378 | Particle Technology | 6 CR |
| M-CIWVT-104383 | Kinetics and Catalysis | 6 CR |
| M-CIWVT-104384 | Biotechnological Production <i>First usage possible until Sep 30, 2025.</i> | 6 CR |
| M-CIWVT-104388 | Development of an Innovative Food Product | 6 CR |
| M-CIWVT-104391 | Rheology of Disperse Systems | 2 CR |
| M-CIWVT-104395 | Microrheology and High Frequency Rheology | 2 CR |
| M-CIWVT-104397 | Innovation Management for Products & Processes in the Chemical Industry | 4 CR |
| M-CIWVT-104401 | NMR for Engineers | 6 CR |
| M-CIWVT-104422 | Processes and Process Chains for Renewable Resources | 6 CR |
| M-CIWVT-104450 | Measurement Techniques in Chemical Processing (including practical course) | 6 CR |
| M-CIWVT-104451 | Catalytic Micro Reactors | 4 CR |
| M-CIWVT-104461 | Chem-Plant | 4 CR |
| M-MACH-100489 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine I | 4 CR |
| M-MACH-100490 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine II | 4 CR |
| M-MACH-100491 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine III | 4 CR |
| M-MACH-102718 | Product Development – Methods of Product Engineering | 6 CR |
| M-BGU-103399 | Process Engineering in Wastewater Treatment | 6 CR |
| M-CIWVT-104478 | Vacuum Technology | 6 CR |
| M-CIWVT-104489 | Sol-Gel Processes | 4 CR |
| M-CIWVT-104490 | Measurement Techniques in Chemical Processing | 4 CR |
| M-CIWVT-104491 | Catalytic Micro Reactors (including practical course) | 6 CR |
| M-CIWVT-104570 | Biobased Plastics | 4 CR |
| M-MATH-102932 | Numerical Methods in Fluid Mechanics | 4 CR |
| M-MACH-102702 | Organ Support Systems | 4 CR |
| M-MACH-102720 | Principles of Medicine for Engineers | 4 CR |
| M-CHEMBIO-104620 | Food Chemistry Basics | 4 CR |
| M-CIWVT-104886 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR |
| M-CIWVT-103440 | Practical Course in Water Technology | 4 CR |
| M-CIWVT-104973 | Digitization in Particle Technology | 4 CR |
| M-CIWVT-105200 | Liquid Transportation Fuels | 6 CR |
| M-CIWVT-105205 | Microfluidics and Case Studies | 6 CR |
| M-CIWVT-105295 | Biotechnological Use of Renewable Resources | 4 CR |
| M-CIWVT-105380 | Membrane Technologies in Water Treatment <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105399 | Mixing, Stirring, Agglomeration <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105407 | Additive Manufacturing for Process Engineering <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-MATH-103276 | Seminar <i>First usage possible from Apr 01, 2021.</i> | 3 CR |
| M-CIWVT-105782 | Digital Design in Process Engineering <i>First usage possible from Oct 01, 2021.</i> | 6 CR |
| M-CIWVT-105890 | NMR Methods for Product and Process Analysis <i>First usage possible from Apr 01, 2022.</i> | 4 CR |

| | | |
|----------------|--|------|
| M-CIWVT-105891 | Power-to-X – Key Technology for the Energy Transition <i>First usage possible from Apr 01, 2022.</i> | 6 CR |
| M-CIWVT-105903 | Industrial Wastewater Treatment <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-ETIT-105883 | Electrocatalysis <i>First usage possible from Apr 01, 2022.</i> | 5 CR |
| M-CIWVT-105932 | Seminar of Food Processing in Practice <i>First usage possible from Apr 01, 2022.</i> | 2 CR |
| M-CIWVT-105933 | Introduction to Sensory Analysis <i>First usage possible from Apr 01, 2022.</i> | 2 CR |
| M-ETIT-100532 | Batteries and Fuel Cells <i>First usage possible from Oct 01, 2022.</i> | 6 CR |
| M-CIWVT-105993 | Innovative Concepts for Formulation and Processing of Printable Materials <i>First usage possible from Oct 01, 2022.</i> | 4 CR |
| M-CIWVT-105996 | Extrusion Technology in Food Processing <i>First usage possible from Oct 01, 2022.</i> | 4 CR |
| M-ETIT-105594 | Process Analysis: Modeling, Data Mining, Machine Learning <i>First usage possible from Oct 01, 2022.</i> | 4 CR |
| M-BGU-104917 | Wastewater Treatment Technologies <i>First usage possible from Oct 01, 2022.</i> | 6 CR |
| M-BGU-106113 | Modeling Wastewater Treatment Processes <i>First usage possible from Oct 01, 2022.</i> | 6 CR |
| M-CIWVT-106297 | Bioprocess Development <i>First usage possible from Apr 01, 2023.</i> | 6 CR |
| M-CIWVT-106314 | Air Pollution Control – Laws, Technology and Application <i>First usage possible from Apr 01, 2023.</i> | 4 CR |
| M-CIWVT-106313 | Principles of Constrained Static Optimization <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106316 | Nonlinear Process Control <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106317 | Optimal and Model Predictive Control <i>First usage possible from Apr 01, 2023.</i> | 6 CR |
| M-CIWVT-106318 | Control of Distributed Parameter Systems <i>First usage possible from Apr 01, 2023.</i> | 6 CR |
| M-CIWVT-106319 | Data-Based Modeling and Control <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106320 | Estimator and Observer Design <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106501 | Industrial Bioprocesses <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106518 | Electrobiotechnology <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106526 | Journal Club – Novel Bioproduction Systems <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106529 | Membrane Materials & Processes Research Masterclass <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106537 | Reactor Modeling with CFD <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106563 | Production and Development of Cancer Therapeutics <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106564 | Single-Cell Technologies <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106566 | Chemical Hydrogen Storage <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-MATH-106634 | Computational Fluid Dynamics and Simulation Lab <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106680 | Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation <i>First usage possible from Apr 01, 2024.</i> | 5 CR |
| M-CIWVT-106661 | Alternative Protein Technologies <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106676 | Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-106595 | Bioreactor Development | 3 CR |

| | | |
|----------------|---|------|
| M-CIWVT-106698 | Process Engineering for the Production of Food from Plant-Based Raw Materials | 4 CR |
| M-CIWVT-106699 | Process Engineering for the Production of Food from Animal Origins | 4 CR |
| M-CIWVT-103438 | Fundamentals of Water Quality <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-106715 | Advanced Methods in Nonlinear Process Control <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106816 | C1-Biotechnology <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-106835 | Data-Driven Process Engineering Models in Python <i>First usage possible from Oct 01, 2024.</i> | 4 CR |
| M-MATH-101338 | Parallel Computing <i>First usage possible from Oct 01, 2024.</i> | 5 CR |
| M-CIWVT-106823 | Applied Mass Transfer - Energy Systems and Thin Films <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-106837 | Bioprocess Scale-up <i>First usage possible from Oct 01, 2024.</i> | 4 CR |
| M-CIWVT-106838 | Biosensors <i>First usage possible from Oct 01, 2024.</i> | 4 CR |
| M-CIWVT-106832 | Model Development and Simulation in Thermal Process Engineering <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-106882 | Polymer Thermodynamics <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-106881 | Circular Economy <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-107038 | Simulation Technologies <i>First usage possible from Apr 01, 2025.</i> | 6 CR |
| M-CIWVT-107037 | Dynamics of Process Engineering Systems <i>First usage possible from Apr 01, 2025.</i> | 6 CR |
| M-CIWVT-107039 | Thermal Process Engineering II <i>First usage possible from Apr 01, 2025.</i> | 6 CR |
| M-CIWVT-107040 | Thermal Process Engineering III <i>First usage possible from Oct 01, 2025.</i> | 6 CR |
| M-CIWVT-107076 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from Apr 01, 2025.</i> | 8 CR |
| M-CIWVT-107131 | Catalysis for Sustainable Chemicals and Energies <i>First usage possible from Apr 01, 2025.</i> | 4 CR |
| M-CIWVT-107149 | Modern Concepts in Catalysis: From Science to Engineering <i>First usage possible from Apr 01, 2025.</i> | 4 CR |
| M-MACH-107277 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement <i>First usage possible from Apr 01, 2025.</i> | 4 CR |
| M-MACH-107278 | Hydrogen in Materials – Exercises and Lab Course <i>First usage possible from Apr 01, 2025.</i> | 4 CR |

5.4 Specialized Course I

Credits
16

IMPORTANT: Before you can take exams in the specialized courses, the Master Examination Board has to approve your study plan. The selected specialized courses and modules will then be entered in the Campus Management System so that you can register for the exams.

Examinations

Learning control for each module of the specialized course is an oral examination according to Section 4 Paragraph 2 no. 2 of the Studies and Examination Regulations. In exceptional cases, a written examination will take place (see module description).

Some specialized courses are concluded with a block examination:

All modules are examined in a joint oral examination (duration approx. 1 h). Each module is graded separately.

The grades of the modules of a specialized course are included in the subject grade with a weight proportional to the designated credits of the modules.

Election notes

Two specialized courses (specialized course I and specialized course II*) with a scope of 16 credits each are selected. In the master's program Bioengineering, at least one of the following specialized courses has to be selected:

- Biopharmaceutical Process Engineering
- Food Process Engineering
- New Bio-Production Systems - Electro-Biotechnology
- Bioresource Engineering
- Water Technology

* In the module handbook, only specialized course I is described. The same regulations are valid for specialized course II.

| Specialized Course I (Election: 1 item) | |
|---|-------|
| Applied Rheology | 16 CR |
| Automation and Process Systems Engineering <i>First usage possible from Apr 01, 2023.</i> | 16 CR |
| Biopharmaceutical Process Engineering | 16 CR |
| Fuel Technology | 16 CR |
| Chemical Process Engineering | 16 CR |
| Energy Process Engineering | 16 CR |
| Entrepreneurship in Process Engineering <i>First usage possible from Oct 01, 2022.</i> | 16 CR |
| Gas Particle Systems | 16 CR |
| Food Process Engineering | 16 CR |
| New Bio-Production Systems - Electro-Biotechnology <i>First usage possible from Oct 01, 2023.</i> | 16 CR |
| Bioresource Engineering | 16 CR |
| Mechanical Process Engineering | 16 CR |
| Technical Thermodynamics | 16 CR |
| Thermal Process Engineering | 16 CR |
| Environmental Process Engineering | 16 CR |
| Combustion Technology | 16 CR |
| Water Technology | 16 CR |

5.4.1 Applied Rheology**Part of: Specialized Course I****Credits****16**

Type of examination: Oral examination of the module combination

Election notes

One of the following two modules has to be chosen:

- Rheology and Processing of Disperse Systems
- Rheology and Processing of Polymers

The following modules can't be chosen if the contents are part of another module:

- Rheology of Complex Fluids and Advanced Rheometry
- Rheology and Rheometry
- Rheology of Polymers
- Stability of Disperse Systems
- Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids
- Dimensional Analysis of Fluid Mechanic Problems

The module "Innovative Concepts for Formulation and Processing of Printable Materials" can only be chosen if none of the modules

- Stability of Disperse Systems
- Rheology and Processing of Disperse Systems

has been chosen.

Case studies in the module "Microfluidics" can be dropped. In this case 4 credits are awarded for the module.

| Applied Rheology (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-104322 | Fluid Mechanics of Non Newtonian Fluids | 8 CR |
| M-CIWVT-104326 | Rheology and Rheometry <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104327 | Dimensional Analysis of Fluid Mechanic Problems <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104328 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104329 | Rheology of Polymers | 4 CR |
| M-CIWVT-104330 | Stability of Disperse Systems | 4 CR |
| M-CIWVT-104331 | Rheology of Complex Fluids and Advanced Rheometry | 4 CR |
| M-CIWVT-104335 | Rheology and Processing of Polymers <i>First usage possible until Sep 30, 2025.</i> | 8 CR |
| M-CIWVT-104336 | Rheology and Processing of Disperse Systems | 8 CR |
| M-CIWVT-104350 | Microfluidics | 4 CR |
| M-CIWVT-104370 | Drying Technology | 6 CR |
| M-CIWVT-104886 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR |
| M-CIWVT-105205 | Microfluidics and Case Studies | 6 CR |
| M-CIWVT-105399 | Mixing, Stirring, Agglomeration <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105993 | Innovative Concepts for Formulation and Processing of Printable Materials <i>First usage possible from Oct 01, 2022.</i> | 4 CR |

5.4.2 Automation and Process Systems Engineering**Part of: Specialized Course I****Credits****16****Note regarding usage**

First usage possible from Apr 01, 2023.

Type of examination: Oral examination of each module

Election notes

Compulsory module:

- Nonlinear Process Control

In addition, at least one of the following modules has to be chosen:

- Optimal and Model Predictive Control
- Data-Based Modeling and Control
- Control of Distributed Parameter Systems
- Estimator and Observer Design

| Automation and Process Systems Engineering (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-106316 | Nonlinear Process Control <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106313 | Principles of Constrained Static Optimization <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106317 | Optimal and Model Predictive Control | 6 CR |
| M-CIWVT-106319 | Data-Based Modeling and Control <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106318 | Control of Distributed Parameter Systems | 6 CR |
| M-CIWVT-106320 | Estimator and Observer Design <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106715 | Advanced Methods in Nonlinear Process Control <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-ETIT-105594 | Process Analysis: Modeling, Data Mining, Machine Learning | 4 CR |
| M-CIWVT-104973 | Digitization in Particle Technology | 4 CR |
| M-CIWVT-107038 | Simulation Technologies <i>First usage possible from Apr 01, 2025.</i> | 6 CR |
| M-CIWVT-107037 | Dynamics of Process Engineering Systems <i>First usage possible from Apr 01, 2025.</i> | 6 CR |

5.4.3 Biopharmaceutical Process Engineering**Credits****Part of: Specialized Course I****16**

Type of examination: oral/written examination of each module

Election notes

Prerequisite:

- Compulsory elective module "Biopharmaceutical Purification Processes"

One of the following modules must be chosen:

- Formulation of (Bio)pharmaceutical Therapeutics
- Process Modeling in Downstream Processing
- Industrial Aspects in Bioprocess Technology

| Biopharmaceutical Process Engineering (Election: at least 16 credits) | | |
|--|---|------|
| M-CIWVT-103066 | Process Modeling in Downstream Processing | 4 CR |
| M-CIWVT-104266 | Formulation of (Bio)pharmaceutical Therapeutics | 4 CR |
| M-CIWVT-104273 | Commercial Biotechnology | 4 CR |
| M-MACH-100489 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine I | 4 CR |
| M-MACH-100490 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine II | 4 CR |
| M-MACH-100491 | BioMEMS - Microsystems Technologies for Life Sciences and Medicine III | 4 CR |
| M-MACH-102702 | Organ Support Systems | 4 CR |
| M-MACH-102720 | Principles of Medicine for Engineers | 4 CR |
| M-CIWVT-105412 | Industrial Aspects in Bioprocess Technology | 4 CR |
| M-CIWVT-105890 | NMR Methods for Product and Process Analysis <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-CIWVT-106501 | Industrial Bioprocesses <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106563 | Production and Development of Cancer Therapeutics <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106835 | Data-Driven Process Engineering Models in Python <i>First usage possible from Oct 01, 2024.</i> | 4 CR |

5.4.4 Fuel Technology**Part of: Specialized Course I****Credits****16**

Type of examination: Oral examination of each module

Election notes

- The module "Fuel Technology" is mandatory.
- The module "Refinery Technology - Liquid Fuels" can't be chosen if the module "Liquid Transportation Fuels" has been chosen in another subject.

| Fuel Technology (Election: at least 16 credits) | | |
|--|---|------|
| M-CIWVT-103069 | Combustion Technology | 6 CR |
| M-CIWVT-103075 | High Temperature Process Engineering | 6 CR |
| M-CIWVT-104287 | Catalytic Processes in Gas Technologies | 4 CR |
| M-CIWVT-104288 | Biomass Based Energy Carriers | 6 CR |
| M-CIWVT-104289 | Fuel Technology | 6 CR |
| M-CIWVT-104291 | Refinery Technology - Liquid Fuels | 6 CR |
| M-CIWVT-104292 | Fluidized Bed Technology | 4 CR |
| M-CIWVT-104352 | Process and Plant Safety | 4 CR |
| M-CIWVT-104296 | Hydrogen and Fuel Cell Technologies | 4 CR |
| M-CIWVT-106566 | Chemical Hydrogen Storage <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-107076 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from Apr 01, 2025.</i> | 8 CR |
| M-CIWVT-106676 | Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from Oct 01, 2025.</i> | 8 CR |

5.4.5 Chemical Process Engineering**Part of: Specialized Course I****Credits****16**

Type of examination:

- Oral examination of each module
- Exception: Module "Reactor Modeling with CFD": Examination of another type (written report)

Election notes

The module "Chemical Process Engineering II" is mandatory.

The following modules can't be combined:

- Catalytic Micro Reactors
- Design of Micro Reactors

| Chemical Process Engineering (Election: at least 16 credits) | | |
|---|---|------|
| M-CIWVT-104283 | Reaction Kinetics | 6 CR |
| M-CIWVT-104284 | Sol-Gel-Processes (Including Practical Course) | 6 CR |
| M-CIWVT-104286 | Design of Micro Reactors | 6 CR |
| M-CIWVT-104450 | Measurement Techniques in Chemical Processing (including practical course) | 6 CR |
| M-CIWVT-104451 | Catalytic Micro Reactors | 4 CR |
| M-CIWVT-104489 | Sol-Gel Processes | 4 CR |
| M-CIWVT-104490 | Measurement Techniques in Chemical Processing | 4 CR |
| M-CIWVT-104491 | Catalytic Micro Reactors (including practical course) | 6 CR |
| M-CIWVT-104281 | Chemical Process Engineering II | 6 CR |
| M-CIWVT-106537 | Reactor Modeling with CFD <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106566 | Chemical Hydrogen Storage <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106809 | Computer-Aided Reactor Design <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-107025 | Engineering Heterogeneous Catalysis <i>First usage possible from Apr 01, 2025.</i> | 6 CR |

5.4.6 Energy Process Engineering**Credits****Part of: Specialized Course I****16**

Type of examination: Oral examination of each module

Election notes

The module "Fuel Technology" is mandatory unless the specialized course "Fuel Technology" has been chosen as second specialized course.

In addition, one of the following modules has to be chosen:

- Combustion Technology
- High Temperature Process Engineering

| Energy Process Engineering (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-103069 | Combustion Technology | 6 CR |
| M-CIWVT-103075 | High Temperature Process Engineering | 6 CR |
| M-CIWVT-104288 | Biomass Based Energy Carriers | 6 CR |
| M-CIWVT-104289 | Fuel Technology | 6 CR |
| M-CIWVT-104292 | Fluidized Bed Technology | 4 CR |
| M-CIWVT-104293 | Energy Technology | 4 CR |
| M-CIWVT-104295 | Combustion and Environment | 4 CR |
| M-CIWVT-104296 | Hydrogen and Fuel Cell Technologies | 4 CR |
| M-CIWVT-104297 | Measurement Techniques in the Thermo-Fluid Dynamics | 6 CR |
| M-CIWVT-105206 | Design of a Jet Engine Combustion Chamber <i>First usage possible from Oct 01, 2019.</i> | 6 CR |
| M-CIWVT-104352 | Process and Plant Safety | 4 CR |
| M-CIWVT-106676 | Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-107076 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from Apr 01, 2025.</i> | 8 CR |

5.4.7 Entrepreneurship in Process Engineering**Credits****Part of: Specialized Course I****16****Note regarding usage**

First usage possible from Oct 01, 2022.

Type of examination: written/oral examination of each module

The learning control in the module "Students Innovation Lab" includes a written examination as well as an examination of another type. Examinations in all other modules are oral.

Election notes

The module "Students Innovation Lab" is mandatory.

Within the module "Students Innovation Lab" you can choose between two different projects.

- Project 1: Innovation Project Porous Ceramics from the 3D Printer
- Project 2: Innovation Project Electronic Devices from Printable Conductive Materials

Election regulations

Elections in this field require confirmation.

| Entrepreneurship in Process Engineering (Election: at least 16 credits) | | |
|--|---|-------|
| M-CIWVT-104330 | Stability of Disperse Systems | 4 CR |
| M-CIWVT-105993 | Innovative Concepts for Formulation and Processing of Printable Materials | 4 CR |
| M-CIWVT-106017 | Students Innovation Lab | 12 CR |

5.4.8 Gas Particle Systems**Part of: Specialized Course I****Credits****16**

Type of examination: Oral examination of the module combination **OR** oral examination of each module

Election notes

Compulsory module:

- Gas Particle Measurement Technology

The following modules can't be combined:

- Dimensional Analysis of Fluid Mechanic Problems
- Data Analysis and Statistics

| Gas Particle Systems (Election: at least 16 credits) | | |
|---|---|------|
| M-CIWVT-104292 | Fluidized Bed Technology | 4 CR |
| M-CIWVT-104327 | Dimensional Analysis of Fluid Mechanic Problems <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104337 | Gas Particle Measurement Technology | 6 CR |
| M-CIWVT-104339 | Nanoparticles – Structure and Function | 6 CR |
| M-CIWVT-104340 | Gas Particle Separation Processes | 6 CR |
| M-CIWVT-104345 | Data Analysis and Statistics | 4 CR |
| M-CIWVT-104973 | Digitization in Particle Technology | 4 CR |
| M-CIWVT-106314 | Air Pollution Control - Laws, Technology and Application <i>First usage possible from Apr 01, 2023.</i> | 4 CR |

5.4.9 Food Process Engineering**Part of: Specialized Course I****Credits****16**

Type of examination: Oral examination of each module; on request a combined examination is possible.

Exception: The examination in the module "Membrane Technologies in Water Treatment" is a written examination.

Election notes

Compulsory modules:

- Unit Operations and Process Chains for Food of Plant Origin
- Unit Operations and Process Chains for Food of Animal Origin

| Food Process Engineering (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-103407 | Water Technology | 6 CR |
| M-CIWVT-104319 | Microbiology for Engineers | 4 CR |
| M-CIWVT-104370 | Drying Technology | 6 CR |
| M-CHEMBIO-104620 | Food Chemistry Basics | 4 CR |
| M-CIWVT-105380 | Membrane Technologies in Water Treatment <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105399 | Mixing, Stirring, Agglomeration <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105932 | Seminar of Food Processing in Practice <i>First usage possible from Apr 01, 2022.</i> | 2 CR |
| M-CIWVT-105933 | Introduction to Sensory Analysis <i>First usage possible from Apr 01, 2022.</i> | 2 CR |
| M-CIWVT-105996 | Extrusion Technology in Food Processing <i>First usage possible from Oct 01, 2022.</i> | 4 CR |
| M-CIWVT-106661 | Alternative Protein Technologies <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106698 | Process Engineering for the Production of Food from Plant-Based Raw Materials <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106699 | Process Engineering for the Production of Food from Animal Origins <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-104388 | Development of an Innovative Food Product <i>First usage possible from Apr 01, 2025.</i> | 6 CR |

5.4.10 New Bio-Production Systems - Electro-Biotechnology**Credits****Part of: Specialized Course I****16****Note regarding usage**

First usage possible from Oct 01, 2023.

Type of examination: Oral examination of each module; on request a combined examination is possible.

Exceptions:

- The examination in the module "Commercial Biotechnology" is a written examination if there are many participants.
- In the module "Journal Club" the two oral presentations will be marked, furthermore an active participation in the seminar is required.

Election notes

Compulsory module:

- Electrobiotechnology

Only one of the following two modules may be chosen:

- Batteries and Fuel Cells
- Battery and Fuel Cells Systems

It is recommended to choose the module "Modelling and Simulation of Electrochemical Systems" only in combination with the module "Batteries and Fuel Cells" or "Battery and Fuel Cells Systems".

| New Bio-Production Systems - Electro-Biotechnology (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-106518 | Electrobiotechnology | 6 CR |
| M-CIWVT-106816 | C1-Biotechnology <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-105295 | Biotechnological Use of Renewable Resources | 4 CR |
| M-CIWVT-106526 | Journal Club - Novel Bioproduction Systems <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106678 | Industrial Biocatalysis <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-103441 | Biofilm Systems <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-104570 | Biobased Plastics | 4 CR |
| M-CIWVT-104273 | Commercial Biotechnology <i>First usage possible from Apr 01, 2023.</i> | 4 CR |
| M-CHEMBIO-106204 | Molecular Biology and Genetics <i>First usage possible from Oct 01, 2025.</i> | 5 CR |
| M-ETIT-105883 | Electrocatalysis <i>First usage possible from Apr 01, 2023.</i> | 5 CR |
| M-CHEMBIO-106697 | Electrochemistry <i>First usage possible from Apr 01, 2024.</i> | 3 CR |
| M-ETIT-100532 | Batteries and Fuel Cells | 6 CR |
| M-ETIT-100377 | Battery and Fuel Cells Systems <i>First usage possible from Apr 01, 2023.</i> | 3 CR |
| M-ETIT-100508 | Modelling and Simulation of Electrochemical Systems <i>First usage possible from Apr 01, 2023.</i> | 3 CR |
| M-CIWVT-106838 | Biosensors <i>First usage possible from Oct 01, 2024.</i> | 4 CR |

5.4.11 Bioresource Engineering**Part of: Specialized Course I****Credits****16**

Type of examination: Oral examination of each module. On request a combined examination is possible.

Exceptions:

- The examination in the modules "Selected Formulation Technologies" and "Membrane Technologies in Water Treatment" is a written examination.
- The examination in the modules "Commercial Biotechnology" and "Biobased Plastics" is a written examination if there are many participants.

Election notes

Compulsory module:

- Processes and Process Chains for Renewable Resources

The following modules can't be chosen if they have already been chosen as Advanced Fundamentals:

- Selected Formulation Technologies
- Membrane Technologies in Water Treatment

| Bioresource Engineering (Election: at least 16 credits) | | |
|--|--|------|
| M-CIWVT-104273 | Commercial Biotechnology | 4 CR |
| M-CIWVT-104288 | Biomass Based Energy Carriers | 6 CR |
| M-CIWVT-104397 | Innovation Management for Products & Processes in the Chemical Industry | 4 CR |
| M-CIWVT-104422 | Processes and Process Chains for Renewable Resources | 6 CR |
| M-CIWVT-104570 | Biobased Plastics | 4 CR |
| M-CIWVT-103441 | Biofilm Systems | 4 CR |
| M-CHEMBIO-104620 | Food Chemistry Basics | 4 CR |
| M-CIWVT-104266 | Formulation of (Bio)pharmaceutical Therapeutics | 4 CR |
| M-CIWVT-104342 | Solid Liquid Separation | 8 CR |
| M-CIWVT-105380 | Membrane Technologies in Water Treatment <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105399 | Mixing, Stirring, Agglomeration <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105295 | Biotechnological Use of Renewable Resources <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-CIWVT-106698 | Process Engineering for the Production of Food from Plant-Based Raw Materials <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106699 | Process Engineering for the Production of Food from Animal Origins <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106837 | Bioprocess Scale-up <i>First usage possible from Apr 01, 2025.</i> | 4 CR |

5.4.12 Mechanical Process Engineering**Credits****Part of: Specialized Course I****16**

Type of examination: Oral examination of each module

Exception: The examination in the module "Selected Formulation Technologies" is a written examination.

Election notes

- Modules/courses that have already been taken during the bachelor's program as part of a specialization shouldn't be chosen.
- Case studies in the module "Microfluidics" can be dropped. In this case 4 credits are awarded for the module.
- The practical course in the module "Sol-Gel-Processes" can be dropped. In this case 4 credits are awarded for the module.
- Only one of the modules "NMR for Engineers" and "NMR Methods for Product and Process Analysis" can be chosen. Both modules contain the same course. The module "NMR for Engineers" additionally includes a practical course.

| Processes for Particle Engineering (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-103073 | Processing of Nanostructured Particles | 6 CR |
| M-CIWVT-104284 | Sol-Gel-Processes (Including Practical Course) | 6 CR |
| M-CIWVT-104327 | Dimensional Analysis of Fluid Mechanic Problems <i>First usage possible until Sep 30, 2025.</i> | 4 CR |
| M-CIWVT-104339 | Nanoparticles – Structure and Function | 6 CR |
| M-CIWVT-104340 | Gas Particle Separation Processes | 6 CR |
| M-CIWVT-104342 | Solid Liquid Separation | 8 CR |
| M-CIWVT-104345 | Data Analysis and Statistics | 4 CR |
| M-CIWVT-104350 | Microfluidics | 4 CR |
| M-CIWVT-104351 | Process Instruments and Machinery and Their Process Integration | 4 CR |
| M-CIWVT-104353 | Materials and Processes for Electrochemical Storage | 4 CR |
| M-CIWVT-104401 | NMR for Engineers | 6 CR |
| M-MATH-102932 | Numerical Methods in Fluid Mechanics | 4 CR |
| M-CIWVT-104489 | Sol-Gel Processes | 4 CR |
| M-CIWVT-104337 | Gas Particle Measurement Technology | 6 CR |
| M-CIWVT-104973 | Digitization in Particle Technology | 4 CR |
| M-CIWVT-105205 | Microfluidics and Case Studies | 6 CR |
| M-CIWVT-105399 | Mixing, Stirring, Agglomeration <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-MATH-103276 | Seminar <i>First usage possible from Apr 01, 2021.</i> | 3 CR |
| M-CIWVT-105890 | NMR Methods for Product and Process Analysis <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-CIWVT-106314 | Air Pollution Control - Laws, Technology and Application <i>First usage possible from Apr 01, 2023.</i> | 4 CR |
| M-CIWVT-106501 | Industrial Bioprocesses <i>First usage possible from Oct 01, 2023.</i> | 4 CR |
| M-MATH-106634 | Computational Fluid Dynamics and Simulation Lab <i>First usage possible from Apr 01, 2024.</i> | 4 CR |
| M-CIWVT-106835 | Data-Driven Process Engineering Models in Python <i>First usage possible from Oct 01, 2024.</i> | 4 CR |
| M-MATH-101338 | Parallel Computing <i>First usage possible from Oct 01, 2024.</i> | 5 CR |
| M-CIWVT-106676 | Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-106565 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible between Apr 01, 2025 and Apr 01, 2025.</i> | 8 CR |
| M-CIWVT-107037 | Dynamics of Process Engineering Systems <i>First usage possible from Apr 01, 2025.</i> | 6 CR |
| M-CIWVT-107076 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from Apr 01, 2025.</i> | 8 CR |

5.4.13 Technical Thermodynamics**Credits****Part of: Specialized Course I****16**

Type of examination: Oral examination of each module

Election notes

Prerequisite:

- Compulsory elective module "Thermodynamics III"

At least two of the following modules have to be chosen:

- Statistical Thermodynamics
- Refrigeration B - Foundations of Industrial Gas Processing
- Physical Foundations of Cryogenics
- Cryogenic Engineering
- Thermodynamics of Interfaces
- Complex Phase Equilibria

The practical course in the module "Sol-Gel-Processes" can be dropped. In this case 4 credits are awarded for the module.

| Technical Thermodynamics (Election: at least 16 credits) | | |
|---|--|------|
| M-CIWVT-103059 | Statistical Thermodynamics | 6 CR |
| M-CIWVT-103063 | Thermodynamics of Interfaces | 4 CR |
| M-CIWVT-103068 | Physical Foundations of Cryogenics | 6 CR |
| M-CIWVT-104284 | Sol-Gel-Processes (Including Practical Course) | 6 CR |
| M-CIWVT-104354 | Refrigeration B - Foundations of Industrial Gas Processing | 6 CR |
| M-CIWVT-104356 | Cryogenic Engineering | 6 CR |
| M-CIWVT-104478 | Vacuum Technology | 6 CR |
| M-CIWVT-104489 | Sol-Gel Processes | 4 CR |
| M-CIWVT-104461 | Chem-Plant <i>First usage possible from Apr 01, 2023.</i> | 4 CR |
| M-CIWVT-104297 | Measurement Techniques in the Thermo-Fluid Dynamics <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-104283 | Reaction Kinetics <i>First usage possible from Oct 01, 2023.</i> | 6 CR |
| M-CIWVT-106882 | Polymer Thermodynamics <i>First usage possible from Oct 01, 2024.</i> | 6 CR |

5.4.14 Thermal Process Engineering**Credits****Part of: Specialized Course I****16**

- Type of examination: Oral examination of each module
- For the following modules a combined examination is possible:
 - Heat Transfer II
 - Mass Transfer II
 - Heat Exchangers

Election notes

At least one of the following modules has to be chosen:

- Thermal Process Engineering III
- Heat Transfer II
- Mass Transfer II
- Model Development and Simulation in Thermal Process Engineering
- Heat Exchangers
- Drying Technology

In addition, at least one other module has to be chosen from the following list:

- Thermal Process Engineering III
- Heat Transfer II
- Mass Transfer II
- Model Development and Simulation in Thermal Process Engineering
- Heat Exchangers
- Drying Technology
- Applied Mass Transfer - Energy Systems and Thin Films
- High Temperature Process Engineering
- Measurement Techniques in the Thermo-Fluid Dynamics

Only one of the following modules can be chosen:

- Drying Technology
- Applied Mass Transfer - Energy Systems and Thin Films

| Thermal Process Engineering (Election: at least 16 credits) | | |
|--|---|------|
| M-CIWVT-103051 | Heat Transfer II | 6 CR |
| M-CIWVT-103059 | Statistical Thermodynamics | 6 CR |
| M-CIWVT-103075 | High Temperature Process Engineering | 6 CR |
| M-CIWVT-104297 | Measurement Techniques in the Thermo-Fluid Dynamics | 6 CR |
| M-CIWVT-104354 | Refrigeration B - Foundations of Industrial Gas Processing | 6 CR |
| M-CIWVT-104369 | Mass Transfer II | 6 CR |
| M-CIWVT-104370 | Drying Technology | 6 CR |
| M-CIWVT-104371 | Heat Exchangers | 4 CR |
| M-CIWVT-104352 | Process and Plant Safety | 4 CR |
| M-CIWVT-106823 | Applied Mass Transfer - Energy Systems and Thin Films <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-106832 | Model Development and Simulation in Thermal Process Engineering <i>First usage possible from Oct 01, 2024.</i> | 6 CR |
| M-CIWVT-104461 | Chem-Plant <i>First usage possible from Oct 01, 2024.</i> | 4 CR |
| M-CIWVT-107040 | Thermal Process Engineering III <i>First usage possible from Oct 01, 2025.</i> | 6 CR |

5.4.15 Environmental Process Engineering**Credits****Part of: Specialized Course I****16**

Type of examination: Oral examination of each module

Election notes

At least one of the following modules has to be chosen:

- Water Technology
- Gas Particle Separation Processes
- Combustion and Environment
- Applied Combustion Technology

The module "Liquid Transportation Fuels" can't be chosen if the module "Refinery Technology - Liquid Fuels" has been chosen in another subject.

| Environmental Process Engineering (Election: at least 16 credits) | | |
|--|--|------|
| M-CIWVT-103407 | Water Technology | 6 CR |
| M-CIWVT-104289 | Fuel Technology | 6 CR |
| M-CIWVT-104340 | Gas Particle Separation Processes | 6 CR |
| M-CIWVT-104352 | Process and Plant Safety | 4 CR |
| M-CIWVT-105200 | Liquid Transportation Fuels | 6 CR |
| M-CIWVT-105903 | Industrial Wastewater Treatment <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-CIWVT-106314 | Air Pollution Control - Laws, Technology and Application <i>First usage possible from Apr 01, 2023.</i> | 4 CR |
| M-CIWVT-104295 | Combustion and Environment | 4 CR |

5.4.16 Combustion Technology**Credits****Part of: Specialized Course I****16**

Type of examination: Both an overall oral examination of the module combination and an examination of the individual modules are possible.

Election notes

Compulsory module:

- Combustion Technology

| Combustion Technology (Election: at least 16 credits) | | |
|--|--|------|
| M-CIWVT-103069 | Combustion Technology | 6 CR |
| M-CIWVT-103075 | High Temperature Process Engineering | 6 CR |
| M-CIWVT-104288 | Biomass Based Energy Carriers | 6 CR |
| M-CIWVT-104289 | Fuel Technology | 6 CR |
| M-CIWVT-104293 | Energy Technology | 4 CR |
| M-CIWVT-104294 | Flow and Combustion Instabilities in Technical Burner Systems | 4 CR |
| M-CIWVT-104295 | Combustion and Environment | 4 CR |
| M-CIWVT-104296 | Hydrogen and Fuel Cell Technologies | 4 CR |
| M-CIWVT-104297 | Measurement Techniques in the Thermo-Fluid Dynamics | 6 CR |
| M-CIWVT-105206 | Design of a Jet Engine Combustion Chamber <i>First usage possible from Oct 01, 2019.</i> | 6 CR |
| M-CIWVT-104321 | Practical Course Combustion Technology | 4 CR |
| M-CIWVT-106676 | Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from Oct 01, 2024.</i> | 8 CR |
| M-CIWVT-107076 | Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from Apr 01, 2025.</i> | 8 CR |

5.4.17 Water Technology**Credits****Part of: Specialized Course I****16**

Type of examination: Oral examination of the module combination

Exception: The examination in the modules *Membrane Technologies in Water Treatment* and *Fundamentals of Water Quality* are written examinations.

Election notes

Compulsory module:

- Water Technology

In addition, at least one of the following modules has to be chosen:

- Fundamentals of Water Quality
- Industrial Wastewater Treatment
- Membrane Technologies in Water Treatment

Further requirements:

- Only one of the modules "NMR for Engineers" and "NMR Methods for Product and Process Analysis" can be chosen.
- The module "Water Quality Assessment" should not be chosen if the specialization "Water Quality and Process Engineering of Water and Waste Water Treatment" has been chosen in the bachelor's program.

| Water Technology (Election: at least 16 credits) | | |
|---|---|------|
| M-CIWVT-103407 | Water Technology | 6 CR |
| M-CIWVT-103441 | Biofilm Systems | 4 CR |
| M-CIWVT-104319 | Microbiology for Engineers | 4 CR |
| M-CIWVT-104401 | NMR for Engineers | 6 CR |
| M-CIWVT-103440 | Practical Course in Water Technology <i>First usage possible from Oct 01, 2019.</i> | 4 CR |
| M-CIWVT-105380 | Membrane Technologies in Water Treatment <i>First usage possible from Apr 01, 2020.</i> | 6 CR |
| M-CIWVT-105890 | NMR Methods for Product and Process Analysis <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-CIWVT-105903 | Industrial Wastewater Treatment <i>First usage possible from Apr 01, 2022.</i> | 4 CR |
| M-CIWVT-103438 | Fundamentals of Water Quality <i>First usage possible from Oct 01, 2024.</i> | 6 CR |

5.5 Internship**Credits****14**

| Mandatory | | |
|------------------|-------------------|-------|
| M-CIWVT-104527 | Internship | 14 CR |

5.6 Additional Examinations

| Additional Examinations (Election: at most 30 credits) | | |
|---|---|-------|
| M-CIWVT-104389 | Process Development in the Chemical Industry | 2 CR |
| M-FORUM-106753 | Supplementary Studies on Science, Technology and Society <i>First usage possible from Oct 01, 2024.</i> | 16 CR |

6 Modules

M

6.1 Module: Model Development and Simulation in Thermal Process Engineering [M-CIWVT-106832]

Responsible: Prof. Dr.-Ing. Tim Zeiner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Thermal Process Engineering](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-113702 | Model Development and Simulation in Thermal Process Engineering | 6 CR | Zeiner |

Competence Certificate

Learning control is an examination of another type. Term paper (max 30 pages) and presentation (duration approx. 20 minutes).

Prerequisites

None.

Module grade calculation

The module grade is the grade of the examination of another type.

Workload

Attendance time:

- Introduction and group meetings: 45 h

Self-study

- Group work/ programming: 90 h
- preparation term paper: 30 h
- preparation presentation: 15 h

Recommendation

Thermal Transport Processes, Thermodynamics III

M**6.2 Module: Additive Manufacturing for Process Engineering [M-CIWVT-105407]**

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: **Technical Supplement Course** (Usage from 4/1/2020)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-110902 | Additive Manufacturing for Process Engineering - Examination | 5 CR | Klahn |
| T-CIWVT-110903 | Practical in Additive Manufacturing for Process Engineering | 1 CR | Klahn |

Competence Certificate

Learning control consists of:

- Practical (ungraded)
- Oral examination with a duration of about 30 minutes

Prerequisites

Das Modul [M-CIWVT-105782 – Digital Design in Process Engineering] wird als Grundlage empfohlen.

Competence Goal

Students are familiar with the concept of a fully digital fabrication chain using and linking together modeling and simulation, computer aided design and 3D printing. They know the most important 3D printing methods suitable for process engineering applications. Moreover, they are able to use standard tools for 3D data generation and they already own hands on practical experience with the use of a metal 3D printer for fabrication of highly precise parts with complex shape.

Content

The rationale for additive manufacturing and key aspects of this approach are explained. An overview of different methods and materials for 3D printing is given with a focus on the use of 3D printed parts or fully functional devices in chemical and process engineering. Tools for 3D data generation for additive manufacturing are introduced and design rules for selected 3D printing methods are explained. Illustrative examples for 3D printed components and functional devices in process engineering are presented and discussed based on literature and own research. In the practical, students will work together in small groups on a fully digital fabrication of functional parts by selective laser melting of metal powder going through a cycle of 3D data generation, 3D printing, and finishing of the printed parts.

Module grade calculation

Module grade is the grade of the oral examination.

Workload

Lectures: 30 h

Practical: 16 h (8 experiments)

Homework: 90 h

Exam Preparation: 44 h

Total: 180 h

Literature

- Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani: Additive Manufacturing Technologies, Springer Nature Switzerland, 2021, DOI: 10.1007/978-3-030-56127-7
- Christoph Klahn, Mirko Meboldt, Filippo Fontana, Bastian Leutenecker-Twelsiek, Jasmin Jansen, Daniel Omidvarkarjan: Entwicklung und Konstruktion für die Additive Fertigung, Vogel Business Media, Würzburg, 2021, ISBN 978-3-8343-3469-5

M**6.3 Module: Advanced Methods in Nonlinear Process Control [M-CIWVT-106715]**

Responsible: Dr.-Ing. Pascal Jerono
Prof. Dr.-Ing. Thomas Meurer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 4/1/2024)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------------|
| T-CIWVT-113490 | Advanced Methods in Nonlinear Process Control | 4 CR | Jerono, Meurer |

Competence Certificate

The learning control is an oral exam lasting approx. 45 minutes.

Prerequisites

None

Competence Goal

Students have an in-depth understanding of methods and concepts for the analysis and the control of nonlinear dynamic systems. They understand the underlying mathematical concepts and can apply them to new problems. They are able to independently design non-linear controls for specific problems and analyze the stability of the closed-loop system.

Content

The module covers selected advanced methods in nonlinear control of finite-dimensional systems that directly exploit the nonlinear system dynamics and result in control concepts relevant for different applications. This includes in particular:

- Lyapunov theory and Lyapunov-based design methods
- Dissipativity and passivity-based control concepts
- Input-to-state stability

Problem sets are considered in the exercises to apply the developed methods using analytical tools as well as computer algebra systems to realize the design approaches.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: Lecture 30 hrs
- Homework: 30 hrs
- Exam preparation: 60 hrs

Literature

- T. Meurer, P. Jerono: Advanced Methods in Nonlinear Control, Lecture Notes.
- T. Meurer: Nonlinear Process Control, Lecture Notes.
- B. Brogliato, R. Lozano, B. Maschke, O. Egeland: Dissipative systems analysis and control, Springer, 2007.
- H.K. Khalil: Nonlinear Systems, Prentice Hall, 2002.
- M. Krstic, I. Kanellakopoulos, P. Kokotovic: Nonlinear and Adaptive Control Design, John Wiley & Sons, 1995.
- R. Sepulchre, M. Jankovic, P.V. Kokotovic: Constructive Nonlinear Control, Springer-Verlag, 1997.
- A.J. van der Schaft: L2-gain and passivity techniques in nonlinear control, Springer, 2016.
- M. Vidyasagar: Nonlinear Systems Analysis, SIAM, 2002.

M**6.4 Module: Air Pollution Control - Laws, Technology and Application [M-CIWVT-106314]**

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2023)
[Specialized Course I / Gas Particle Systems](#) (Usage from 4/1/2023)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2023)
[Specialized Course I / Environmental Process Engineering](#) (Usage from 4/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-112812 | Air Pollution Control - Laws, Technology and Application | 4 CR | Dittler |

Competence Certificate

Oral examination, duration approx. 20 minutes.

Prerequisites

None

Competence Goal

Students develop an understanding of the broad subject area of air pollution control. They are able to define application-oriented solutions for emission reduction and know the essential problems in the operational behavior of the respective components of the applied technologies for air pollution control / presentation of required limit values (oxidation catalyst, particulate filter, SCR catalyst, ammonia slip catalyst). The students learn to classify current issues in air pollution control objectively and to evaluate them independently.

Content

- Air pollutants - definition
- Legal framework: Legislation for emission and immission, EU, worldwide - meaning & differences
- Development of emissions and immissions, current problem areas
- Technologies for air pollution control
- Oxidation catalysts: Structure, function, design & application
- Particulate filters: structure, function & design of particulate filters, soot and ash separation; aging of systems due to ash deposits; ash removal
- DeNOx systems - exhaust gas cleaning by means of selective catalytic reduction: basic reactions; possible reducing agents; AdBlue® - specification & preparation; characterization of applied catalysts; structure, function & design of systems
- Combined exhaust gas aftertreatment systems - structure & mode of operation

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 h
- Self-study: 50 h
- Exam preparation: 40 h

M

6.5 Module: Alternative Protein Technologies [M-CIWVT-106661]**Responsible:** PD Dr.-Ing. Azad Emin**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|------|
| T-CIWVT-113429 | Alternative Protein Technologies | 4 CR | Emin |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

Upon successful completion of this module, students will be able to:

1. Understand and describe the fundamental aspects of various alternative proteins, including plant-based, fermentation-derived, and cultivated meat and dairy alternatives.
2. Evaluate the nutritional profiles and sensory properties of meat and dairy substitutes.
3. Grasp the basic principles of material science that are applicable to the development of alternative proteins.
4. Gain familiarity with precision fermentation processes and their practical applications in creating alternative proteins.
5. Recognize the significance and methodology of extrusion technology in enhancing the texture and structure of plant-based proteins.
6. Develop a basic understanding of product design and marketing strategies tailored for alternative proteins.
7. Identify the key technological processes in alternative protein production and their environmental implications.
8. Acquire a foundational awareness of the market dynamics and emerging trends within the alternative protein sector.
9. Participate in practical projects and engage with industry professionals to apply learned concepts in real-world contexts.

Content

This course is designed to offer an academic and technical exploration into the field of alternative protein technologies. It encompasses a detailed study of the science, engineering, and technological aspects behind the development of plant-based, fermentation-derived, and cultivated protein products. Key focus areas include the sustainability challenges associated with conventional meat and dairy production, and the potential of alternative proteins to address these issues.

Participants will delve into the material science principles that guide the development of meat and dairy substitutes, examining texture, structure, and sensory properties. The course will cover advanced topics such as precision fermentation and its role in alternative protein production, the technology behind cultivated meat, and the application of extrusion technology in creating plant-based protein structures.

The curriculum also includes a comprehensive study of the production processes, nutritional profiles, and environmental impacts of various alternative protein sources such as legumes, insects, algae, and mycoprotein. Through this course, students will gain a thorough understanding of the current technologies, challenges, and innovations in the field, equipping them with the knowledge to contribute to the future advancements in the alternative protein sector.

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

Course location: Seminar room, nexnoa GmbH, Durmersheimerstr. 188A, 76189 Karlsruhe

Workload

- Attendance time: 30 hrs.
- Preparation and wrap-up lectures: 30 hrs.
- Exam preparation: 60 hrs.

M**6.6 Module: Applied Mass Transfer - Energy Systems and Thin Films [M-CIWVT-106823]**

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
Dr. Philip Scharfer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Thermal Process Engineering](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|--|
| T-CIWVT-113692 | Applied Mass Transfer - Energy Systems and Thin Films | 8 CR | |

Content

Applied Mass Transfer topics with application-oriented and fundamental experiments with calculations in teams, discussion and evaluation of current research topics, Model presentations in the literature in mass transfer, Hertz-Knudsen diffusion, selective evaporation and drying - surface tension-driven material flows, Marangoni flows, polymer film drying, liquid and film-dominated mass transfer, Mass transfer combined with topics of adsorption, absorption and chemisorption, diffusion and absorption in polymers;

Applied Research topics in the field of energy technology. Discussion of results and model calculations together with the scientific supervisors during colloquia.

Annotation

The number of participants is limited to a maximum of 20 people.

Registration procedure: For information, see the information sheet in ILIAS and on the homepage.

M**6.7 Module: Batteries and Fuel Cells [M-ETIT-100532]****Responsible:** Prof. Dr.-Ing. Ulrike Krewer**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2022)
[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 2 |

| Mandatory | | | |
|---------------|--|------|--------|
| T-ETIT-100983 | Batteries and Fuel Cells | 6 CR | Krewer |

Competence Certificate

Success is assessed in the form of a written examination lasting 120 minutes

Prerequisites

none

Competence Goal

Students gain an understanding of the structure and mode of operation of batteries and fuel cells. They acquire in-depth knowledge of materials, construction concepts, measurement methods, measurement data analysis and modeling, which gives them a practical insight into current areas of application and research topics of electrochemical energy storage and conversion (fuel cells). They are able to communicate with specialists from related disciplines in the field of batteries and fuel cells and can actively contribute to the opinion-forming process in society with regard to energy technology issues.

Content

Fuel cells and batteries used in innovative energy and environmental technology applications will be covered. The course is divided into three sections. Firstly, the basics of thermodynamics, electrochemistry and the lossy mass transport processes involved in energy conversion are discussed. The second section deals with the structure and functional principle of fuel cells and presents the most important approaches to electrical characterization and modelling. Applications in mobile and stationary systems in transportation and energy technology are discussed. The third section deals with electrochemical energy storage systems, with a focus on high-performance batteries for electric traction. Developments to increase energy density and power density are presented here, as well as the electrical characterization and modelling of batteries.

Module grade calculation

The module grade is the grade of the written examination.

Annotation

Will be changed to 6 CR in winter term 25/26 and provided in English.

Workload

1. lecture attendance time: $15 * 2 \text{ h} = 30 \text{ h}$
2. Preparation and follow-up time for lecture: $15 * 6 \text{ h} = 90 \text{ h}$
3. Exercise attendance time: $5 * 2 \text{ h} = 10 \text{ h}$
4. Preparation and follow-up time for exercise: $5 * 4 \text{ h} = 20 \text{ h}$
5. Exam preparation and attendance: included in preparation and follow-up time.

Total: $150 \text{ h} = 5 \text{ CP}$

M**6.8 Module: Battery and Fuel Cells Systems [M-ETIT-100377]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)**Credits**
3**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

| Mandatory | | | |
|---------------|--|------|-------|
| T-ETIT-100704 | Battery and Fuel Cells Systems | 3 CR | Weber |

M**6.9 Module: Biobased Plastics [M-CIWVT-104570]****Responsible:** Prof. Dr. Ralf Kindervater**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Bioresource Engineering](#)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|-------------|
| T-CIWVT-109369 | Biobased Plastics | 4 CR | Kindervater |

Competence Certificate

Verteifungsfach:

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Technisches Ergänzungsfach or a large number of students:

The examination is a written examination with a duration of 90 minutes (section 4 subsection 2 number 1 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Workload

120 h:

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

M**6.10 Module: Biofilm Systems [M-CIWVT-103441]**

Responsible: Dr. Andrea Hille-Reichel
Dr. Michael Wagner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Water Technology](#)
[Specialized Course I / Bioresource Engineering](#)
[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---------------------------------|------|-----------------------|
| T-CIWVT-106841 | Biofilm Systems | 4 CR | Hille-Reichel, Wagner |

Competence Certificate

The learning control is an oral exam lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

Students are able to describe the structure and function of biofilms in natural habitats and technical applications and explain the main influencing factors and processes for the formation of certain biofilms. They are familiar with methods for visualizing the structures.

Content

This lecture aims at providing an overview of biofilm systems, their development, functions, applications, and the techniques used to investigate them. Thus, topics involved will include basics of (biofilm) microbiology, natural (environmental) biofilm systems, their application in technical systems (reactors), and methods used to quantify biofilm development and performance (i.e., imaging techniques, digital image analysis).

Module grade calculation

Grade of the module is the grade of oral examination.

Workload

Attendance time: 30 h

Preparation/follow-up: 30 h

Examination + exam preparation: 60 h

M**6.11 Module: Biomass Based Energy Carriers [M-CIWVT-104288]**

Responsible: Dr.-Ing. Siegfried Bajohr
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Combustion Technology](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-------------------------------------|------|--------|
| T-CIWVT-108828 | Energy from Biomass | 6 CR | Bajohr |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

The course mediates fundamentals and process engineering aspects of biomass conversion and conditioning processes. The students learn to understand and to evaluate processes for biomass utilization by balancing mass and energy streams. Taking into account regional and global feedstock potentials the students are enabled to choose the most efficient conversion technologies.

Content

Fundamentals on biomass and its production pathways to energy carriers like substitute natural gas (SNG), bio diesel or other fuels.

Production, properties, and characterization of biomass.

Potential and sustainability; energy demand and supply, potentials today and in the future, CO₂ emissions and reduction potential.

Utilization and conversion of biogenic oils and fats.

Biochemical conversion to liquid products like alcohols; fermentation to biogas and its upgrading.

Thermochemical conversion of biomass via pyrolysis and gasification; examples for synthesis processes (FT-, CH₄-, CH₃OH-, DME-synthesis).

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

Literature

- Kaltschmitt, M.; Hartmann (Ed.): Energie aus Biomasse, 2. Aufl., Springer Verlag 2009.
- Graf, F.; Bajohr, S. (Hrsg.): Biogas: Erzeugung – Aufbereitung – Einspeisung, 2. Aufl., Oldenbourg Industrieverlag 2013.

M**6.12 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine I [M-MACH-100489]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|---------------|--|------|-------|
| T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 4 CR | Guber |

Competence Certificate

Written exam (75 min)

Prerequisites

none

Competence Goal

The lecture will first address relevant microtechnical manufacturing methods. Then, selected biomedical applications will be presented, as the increasing use of microstructures and microsystems in Life-Sciences and in medicine leads to improved medico-technical products, instruments, and operation and analysis systems.

Content

Introduction into various microtechnical manufacturing methods: LIGA, Micro milling, Silicon Micromachining, Laser Microstructuring, μ EDM, Metal-Etching
Biomaterials, Sterilisation.

Examples of use in the life science sector: basic micro fluidic structures: micro channels, micro filters, micromixers, micropumps, microvalves, Micro and nanotiter plates, Microanalysis systems (μ TAS), Lab-on-chip applications.

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

M**6.13 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine II [M-MACH-100490]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|---------------|---|------|-------|
| T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 4 CR | Guber |

Competence Certificate

Written exam (75 min)

Prerequisites

None

Competence Goal

The lecture will first shortly address some relevant microtechnical manufacturing methods. Then, selected biomedical applications will be presented, as the increasing use of microstructures and microsystems in Life-Sciences and in medicine leads to improved medico-technical products, instruments, and operation and analysis systems.

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

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

M**6.14 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine III [M-MACH-100491]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|---------------|--|------|-------|
| T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 4 CR | Guber |

Competence Certificate

Written exam (75 min)

Prerequisites

none

Competence Goal

The lecture will first shortly address some relevant microtechnical manufacturing methods. Then, selected biomedical applications will be presented, as the increasing use of microstructures and microsystems in Life-Sciences and in medicine leads to improved medico-technical products, instruments, and operation and analysis systems.

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

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

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

M**6.15 Module: Biopharmaceutical Purification Processes [M-CIWVT-103065]**

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(BIW\)](#)
[Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-106029 | Biopharmaceutical Purification Processes | 6 CR | Hubbuch |

Competence Certificate

The examination is a written examination with a duration of 120 minutes (section 4 subsection 2 number 1 SPO).
 The grade of the written examination is the module grade.

Prerequisites

None

Competence Goal

Process development of biopharmaceutical processes

Content

Detailed discussion of biopharmaceutical purification processes

Workload

- Attendance time (Lecture): 60 h
- Homework: 90 h
- Exam Preparation: 30 h

Learning type

- 22705 - Biopharmazeutische Aufarbeitungsverfahren, 3V
- 22706 - Übung zu Biopharmazeutische Aufarbeitungsverfahren, 1Ü

Literature

Vorlesungsskript

M

6.16 Module: Bioprocess Development [M-CIWVT-106297]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(BIW\)](#) (Usage from 4/1/2023)
[Technical Supplement Course](#) (Usage from 4/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|------------|
| T-CIWVT-112766 | Bioprocess Development | 6 CR | Grünberger |

Competence Certificate

Written examination; duration 120 minutes.

Prerequisites

None

Competence Goal

This course aims to provide students with a comprehensive understanding of the principles, techniques and application of bioprocess development regarding the production of biologically based products. Through a combination of lectures, discussions, and exercises, students will gain knowledge and experience about the various stages of bioprocess development. Upon completion of this module, students should have/be able to:

1. Developed an in-depth understanding of the principles and fundamentals of bioprocess development.
2. Developed a thorough understanding of the different types of bioprocesses and their applications.
3. Gained insight into the development of a successfully established industrial bioprocess.
4. Gained insight into cost and sustainability evaluation of bioprocesses.
5. Gained the ability to combine theoretical understanding and practical application.
6. Developed critical thinking and problem-solving skills necessary for identifying and addressing challenges that arise during bioprocess development.
7. Developed skills and knowledge to evaluate the potential of new methods and tools for accelerated bioprocess development.
8. Developed effective communication and teamwork skills necessary for success in a multidisciplinary bioprocess development environment.

Content

The lecture course covers and discusses various topics and their impact onto efficient bioprocess development. This includes:

- Identification and selection of biocatalyst
- Growth and microbial physiology
- Strain engineering
- Strain and process parameter screening
- Bioprocess optimization
- Bioprocess-scale-up
- Cost and sustainability estimation
- Case studies: Discussion of real-world examples of bioprocess development, including case studies of successful and unsuccessful bioprocess development efforts.

Optional topics include:

- Regulatory and quality control requirements for bioprocess development.
- Computational and mathematical modelling tools to simulate, support and optimize bioprocesses development.

Module grade calculation

The grade of the module ist the grade of the written exam.

Workload

- Attendance time: Lectures and Exercises: 60 h
- Homework: 80 h
- Exam preparation: 40 h

M**6.17 Module: Bioprocess Scale-up [M-CIWVT-106837]****Responsible:** Prof. Dr.-Ing. Alexander Grünberger**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2024)[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-------------------------------------|------|------------|
| T-CIWVT-113712 | Bioprocess Scale-up | 4 CR | Grünberger |

M**6.18 Module: Bioreactor Development [M-CIWVT-106595]**

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Prof. Dr.-Ing. Dirk Holtmann

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 3 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-113315 | Bioreactor Development | 3 CR | Holtmann |

M**6.19 Module: Biosensors [M-CIWVT-106838]****Responsible:** Dr. Gözde Kabay**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2024)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|----------------------------|------|-------|
| T-CIWVT-113714 | Biosensors | 4 CR | Kabay |

M**6.20 Module: Biotechnological Production [M-CIWVT-104384]**

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: **Advanced Fundamentals (BIW)** (Usage until 9/30/2025)
Technical Supplement Course (Usage until 9/30/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 2 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-113830 | Seminar Biotechnological Production | 2 CR | Holtmann |
| T-CIWVT-113831 | Biotechnological Production | 4 CR | Holtmann |

Competence Certificate

The learning control consists of two partial achievements:

- Examination of another type/ prerequisite for the oral exam: Seminar talk lasting approx. 10 minutes during the course (graded).
- written examination lasting 120 minutes

Prerequisites

The Seminar "Biotechnological Production" is a precondition for admittance to the written exam.

The following knowledge is required: biochemistry, genetics, cell biology, microbiology.

Competence Goal

Students are able to apply the knowledge of processes for the biotechnological production of certain substances on issues relating to new production processes. They identify common principles and laws of the various processes. They can independently solve problems in the development of process schematics and can use the knowledge mediated in the lecture.

Content

After giving an overview of the historical development of biotechnology common basic principles of biotechnological production processes are presented. Using recent examples and selected products, processes and methods of industrial or microbial biotechnology, plant cell culture techniques and animal cell culture techniques are presented. Selected examples include e.g. the production of microbial biomass, organic acids, alcohols and ketones, amino acids, vitamins, antibiotics, enzymes, biopolymers, flavorings, natural substances with plant cell cultures, monoclonal antibodies and biopharmaceuticals with animal cell cultures in an industrial scale.

Module grade calculation

LP-weighted mean of the two partial achievements.

Workload

- Attendance time (Lecture): 60 hrs
- Self-study: 40 hrs
- Preparation presentation at the seminar: 20 hrs
- Attendance time (Lecture): 60 hrs

Literature

- Sahm, G. Antranikian, K.-P. Stahmann, R. Takors (Eds.): Industrielle Mikrobiologie, Springer-Spektrum-Verlag 2012 (ISBN 978-3-8274-3039-7)
- Chmiel (Ed.): Bioprozesstechnik, Springer-Spektrum-Verlag 3. Auflage 2011 (ISBN 978-3-8274-2476-1)

M**6.21 Module: Biotechnological Use of Renewable Resources [M-CIWVT-105295]****Responsible:** Prof. Dr. Christoph Syldatk**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Bioresource Engineering](#) (Usage from 10/1/2023)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 3 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-113237 | Biotechnological Use of Renewable Resources | 4 CR | Syldatk |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

This lecture conveys the role of biotechnological processes in a future bioeconomy. Possible raw materials, their preparation and subsequent biotechnological implementation into energy carriers, platform chemicals and special microbial products are presented.

Content

After an introduction to the basics of a future bioeconomy and the comparison of chemical and biotechnological industrial processes using renewable resources, their preparation for biotechnological use and their implementation into energy sources (methane, ethanol), platform chemicals (lactate, dicarboxylic acids, amino acids) and special microbial products (polysaccharides, biosurfactants, flavoring substances) and coupling products like bioplastics. The examples of sugar production, papermaking and ethanol production explain various biorefinery concepts.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Lectures: 45 h
- Homework: 45 h
- Exam Preparation: 30 h

M**6.22 Module: C1-Biotechnology [M-CIWVT-106816]****Responsible:** Dr. Anke Neumann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2024)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-113677 | C1-Biotechnology Exam | 4 CR | Neumann |
| T-CIWVT-113678 | C1-Biotechnology Presentation | 2 CR | Neumann |

M**6.23 Module: Catalysis for Sustainable Chemicals and Energies [M-CIWVT-107131]**

Responsible: Arik Malte Beck
 Prof. Dr. Jan-Dierk Grunwaldt
 Dr. Erisa Saraci
 Prof. Dr. Felix Studt
 TT-Prof. Dr. Moritz Wolf

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|--------------------------------------|
| T-CIWVT-114167 | Catalysis for Sustainable Chemicals and Energies | 4 CR | Beck, Grunwaldt, Saraci, Studt, Wolf |

M**6.24 Module: Catalytic Micro Reactors [M-CIWVT-104451]**

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-109087 | Catalytic Micro Reactors | 4 CR | Pfeifer |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Lectures and Exercises: 30 h
- Homework: 50 h
- Exam preparation: 40 h

M**6.25 Module: Catalytic Micro Reactors (including practical course) [M-CIWVT-104491]**

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-109182 | Practical Course Measurement Techniques in Chemical Processing | 2 CR | Pfeifer |
| T-CIWVT-109087 | Catalytic Micro Reactors | 4 CR | Pfeifer |

Competence Certificate

The Examination consists of:

1. Oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO)
2. Ungraded laboratory work (section 4 subsection 3 SPO)

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Practical course: 20 h , Elaboration: 30 h
- Homework: 50 h
- Exam Preparation: 50 h

M**6.26 Module: Catalytic Processes in Gas Technologies [M-CIWVT-104287]**

Responsible: Dr.-Ing. Siegfried Bajohr
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-108827 | Catalytic Processes in Gas Technologies | 4 CR | Bajohr |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

The students know the relevant catalytic processes in gas technology. Understanding the interaction between thermodynamic, mass and heat transfer and reaction kinetic on the basis of concrete examples enables them to evaluate reactor concepts and develop new approaches for catalytic processes.

Content

Sources, utilization, demand and characterization of gaseous chemical energy carriers.

Catalytic processes for production, conditioning and utilization of gaseous energy carriers. Synthesis and utilization (e. g. methanation and steam reforming); exothermic vs. endothermic processes.

Catalytic processes for gas cleaning and conditioning.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 50 h
- Exam Preparation: 40 h

Literature

- Ullmann's Encyclopedia of Industrial Chemistry. Wiley-VCH 2000.
- Jess, A.; Wasserscheid, P.: Chemical Technology. An Integral Textbook, Wiley-VCH 2013.
- Weber, K.: Engineering verfahrenstechnischer Anlagen. Praxishandbuch mit Checklisten und Beispielen. Springer Vieweg 2014.
- Froment, G. F.; Waugh, K. C.: Reaction Kinetics and the Development and Operation of Catalytic Processes, Elsevier 1999.

M

6.27 Module: Chemical Hydrogen Storage [M-CIWVT-106566]**Responsible:** TT-Prof. Dr. Moritz Wolf**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Fuel Technology](#) (Usage from 10/1/2023)
[Specialized Course I / Chemical Process Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|------|
| T-CIWVT-113234 | Chemical Hydrogen Storage | 4 CR | Wolf |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

The students are able to explain basic properties of hydrogen and hydrogen carriers, know the production methods of green hydrogen and can assess its role in the context of the energy transition, especially with regard to industrial use as feedstock. They understand sustainable and emerging technologies for chemical hydrogen storage, can describe the catalysts required for the various processes and know special associated challenges. The students can evaluate different chemical, but also physical storage technologies, assess the costs of individual process steps and describe the corresponding potential areas of application.

Content

- Introduction to various concepts of (chemical) hydrogen storage
 - Storage technologies
 - Carrier molecules
 - Storage cycles
- Processes and catalysts for chemical hydrogen storage technologies
 - Ammonia
 - Liquid organic hydrogen carriers (LOHCs)
 - Dimethylether
- Evaluation of storage processes in comparison with liquid hydrogen
 - Sustainability
 - Costs of production
 - Costs of transportation
 - Costs of hydrogen application

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 40 hrs
- Self-study: 40 hrs
- Exam preparation: 40 hrs

Literature

Announced in lectures/on slides.

Fundamentals:

- I. Chorkendorff, J. W. Niemantsverdriet, *Concepts of Modern Catalysis and Kinetics*, 2003, Wiley.
- R. Schlögl, *Chemical Energy Storage*, 2022, De Gruyter

M**6.28 Module: Chemical Process Engineering II [M-CIWVT-104281]**

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Specialized Course I / Chemical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 3 |

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-108817 | Chemical Process Engineering II | 6 CR | Wehinger |

Competence Certificate

The learning control is an oral examination with a duration of about 20 minutes.

Prerequisites

None

Competence Goal

Students know the film model and are able to apply it for the calculation of mass transport effects in reacting multiphase systems. They know technical two- and three-phase reactors with their fields of application and their limits. For multiphase reactors with well-defined properties, they are able to design reactor dimensions and to calculate suitable process conditions.

Content

Theory of mass transfer and reaction in multiphase reacting systems (film model); technical reactors for two-phase systems (gas-liquid, liquid-liquid, gas-solid); reactors for three-phase systems.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 hrs
- Homework: 50 hrs
- Exam Preparation: 40 hrs

Literature

Skript "Chemische Verfahrenstechnik II"

M**6.29 Module: Chem-Plant [M-CIWVT-104461]**

Responsible: Prof. Dr. Sabine Enders
Prof. Dr.-Ing. Tim Zeiner

Organisation: KIT Department of Chemical and Process Engineering

Part of: **Technical Supplement Course**
Specialized Course I / Thermal Process Engineering (Usage from 10/1/2024)
Specialized Course I / Technical Thermodynamics (Usage from 4/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|------------|------|--------|
| T-CIWVT-109127 | Chem-Plant | 4 CR | Enders |

Prerequisites

None

Competence Goal

The students are able to apply the knowledge of their academic education for the design of a concretely chemical plant and they are able to publish the obtained results.

Content

Design of a complete chemical plant for the production of selected product, participation on the Chem-Plant competition (organized by VDI)

Workload

- Attendance time (Lecture): 10 h
- Projekt work: 60 h
- Presentations and Conference participation: 50 h

M**6.30 Module: Circular Economy [M-CIWVT-106881]**

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 2 terms | German | 4 | 1 |

| Mandatory | | | |
|----------------|----------------------------------|------|-------|
| T-CIWVT-113815 | Circular Economy | 6 CR | Stapf |

Competence Certificate

The learning control ist an Oral exam on lectures, exercises and case studies, lasting approx. 30 minutes.

Prerequisites

None.

Competence Goal

The students understand important material systems and essential process steps of the provision and recycling of mineral and metallic raw materials and anthropogenic carbon. With the aim of closing cycles, they can use methods of process evaluation, such as analysis and assessment of process chains using efficiency indicators.

Content

Introduction to transition in resources and technologies towards a sustainable circular economy. Knowledge acquisition in system analysis, in process efficiency assessment and in sustainability evaluation. Motivation for process engineering research and development in the field of sustainable raw material supply of a climate-neutral society:

- Material flow and process knowledge of the primary and the recycling industries
- Methodological knowledge (business management basics of relevance, material flow analysis, determination of performance indicators)

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

The number of participants is limited to 10.

Participation is not possible if the profile subject Circular Economy was taken in the Bachelor's program.

Workload

- Attendance time: Lectures and exercises: 45 h
- Self-study: Wrap up lectures: 45 h
- Exam preparation: 90 h

M**6.31 Module: Combustion and Environment [M-CIWVT-104295]**

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Environmental Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-108835 | Combustion and Environment | 4 CR | Trimis |

Competence Certificate

Learning Control is an oral examination with a duration of about 20 minutes.

Prerequisites

None

Competence Goal

- The students are able to describe and explain why it is important to protect environment.
- The students are able to name the major combustion pollutants and describe the effect on the environment.
- The students understand the physicochemical mechanisms of the formation of different pollutants in the combustion process.
- The students are able to name and describe primary measures to reduce emissions.
- The students understand the limitations of primary measures and are able to name and describe secondary measures to reduce emissions.
- The students understand and can assess differences of emissions from engine and gas turbine combustion.

Content

- Importance of environmental protection.
- Combustion pollutants and their effects.
- Pollutant formation mechanisms
- Combustion-related measures (primary measures) to reduce emissions.
- Exhaust gas cleaning: secondary measures to reduce emissions.
- Emissions from engine combustion and from combustion in gas turbines.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

M**6.32 Module: Combustion Technology [M-CIWVT-103069]**

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---------------------------------------|------|--------|
| T-CIWVT-106104 | Combustion Technology | 6 CR | Trimis |

Competence Certificate

Learning Control is an oral examination with a duration of about 20 minutes (section 4 subsection 2 SPO). Grade of the module is the grade of the oral examination.

Prerequisites

None

Competence Goal

- The students are able to describe and explain the characteristics of the different flame types.
- The students can quantitatively estimate/calculate major combustion characteristics like flame temperature and flame velocity. They further understand the physicochemical mechanisms affecting flammability limits and quenching distances.
- The students understand and can assess the influence/interaction of turbulence, heat and mass transfer to reacting flows.
- The students understand the flame structure and the hierarchical structure of reaction kinetic mechanisms.
- The students understand and can assess the influence of interaction between different time scales of chemical kinetics and fluid flow in reacting flows.
- The students are able to assess and evaluate burner operability with regard to the application.

Content

- Introduction and significance of combustion technology
- Thermodynamics of combustion: Mass and energy/enthalpy balances
- Equilibrium composition
- Flame temperature
- Reaction mechanisms in combustion processes
- Laminar flame velocity and thermal flame theory
- Kinetics related combustion characteristics and experimental characterization: laminar flame velocity, flammability limits, ignition temperature, ignition energy, ignition delay time, quenching distance, flash point, octane and cetane number
- Turbulent flame propagation
- Industrial burner types

Workload

- Lectures and Exercises: 45 h
- Homework: 25 h
- Exam Preparation: 110 h

Literature

- K.K. Kuo: Principles of Combustion, John Wiley & Sons, Hoboken, New York 2005
- J. Warnatz, U. Maas, R.W. Dibble: Combustion, Springer Verlag, Berlin, Heidelberg 2006
- S.R. Turns: An Introduction to Combustion - Concepts and Applications, McGraw-Hill, Boston 2000
- I. Glassman: Combustion, Academic Press, New York, London 1996

M**6.33 Module: Commercial Biotechnology [M-CIWVT-104273]****Responsible:** Prof. Dr. Ralf Kindervater**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Biopharmaceutical Process Engineering](#)[Specialized Course I / Bioresource Engineering](#)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-------------|
| T-CIWVT-108811 | Commercial Biotechnology | 4 CR | Kindervater |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

In case of large number of participants the examination is a written examination with a duration of 60 minutes (section 4 subsection 2 number 1 SPO).

Prerequisites

None

Module grade calculation

The grade of the oral or written examination is the module grade.

Workload

Lectures: 30 h

Homework: 50 h

Exam Preparation: 40 h (about one week)

M**6.34 Module: Computational Fluid Dynamics [M-CIWVT-103072]**

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(CIW\)](#)
[Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-106035 | Computational Fluid Dynamics | 6 CR | Nirschl |

Competence Certificate

Learning control is a written examination lasting 90 minutes

Prerequisites

None

Competence Goal

Learning the fundamentals of CFD for the calculation of flow problems.

Content

Navier-Stokes equations, numerical schemes, turbulence, multiphase flows.

Module grade calculation

The module grade is the grade of the written examination.

Workload

- Attendance time (Lecture): 64 h
- Homework: 56 h
- Exam Preparation: 601 h

Literature

- Nirschl: Skript zur Vorlesung CFD
- Ferziger, Peric: Numerische Strömungsmechanik
- Oertel, Laurien: Numerische Strömungsmechanik

M**6.35 Module: Computational Fluid Dynamics and Simulation Lab [M-MATH-106634]****Responsible:** PD Dr. Mathias Krause**Organisation:** KIT Department of Mathematics**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German/English | 1 | 2 |

| Mandatory | | | |
|---------------|---|------|--------------------------------|
| T-MATH-113373 | Computational Fluid Dynamics and Simulation Lab | 4 CR | Frank, Krause, Simonis, Thäter |

Competence Certificate

For their final project, students prepare a written report, usually 10-15 pages long, which is graded.

Prerequisites

none

Competence Goal

Students are able to jointly model problems beyond their own discipline and simulate them on high-performance computers. They have acquired a critical distance to results and their presentation. They can defend the results of projects in disputes. They have understood the importance of stability, convergence and parallelism of numerical methods from their own experience and are able to evaluate errors in modeling, approximation, computing and presentation.

Content

Lecture part: Introduction to modeling and simulations, introduction to associated numerical methods, introduction to associated software and high-performance computer hardware

Own group work: Working on 1-2 projects in which modelling, discretization, simulation and evaluation (e.g. visualization) are carried out for specific topics from the catalog. The catalog includes e.g: Diffusion processes, turbulent flows, multiphase flows, reactive flows, particle dynamics, optimal control and optimization under constraints, stabilization methods for advection-dominated transport problems.

Module grade calculation

The module grade is the grade of the final project.

Workload

Total workload: 120 hours

Attendance: 60 hours

- lectures and examination

Self-studies: 60 hours

- follow-up and deepening of the course content,
- work on projects and report,
- literature study and internet research relating to the course content

Recommendation

Basic knowledge of the analysis of boundary value problems and of numerical methods for differential equations is recommended. Knowledge of a programming language is strongly recommended.

M**6.36 Module: Computer-Aided Reactor Design [M-CIWVT-106809]**

Responsible: Martin Kutscherauer
Prof. Dr.-Ing. Gregor Wehinger

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Specialized Course I / Chemical Process Engineering](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German/English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-113667 | Computer-Aided Reactor Design | 6 CR | Wehinger |

Competence Certificate

Learning control is an examination of another type:

Prerequisites

None.

Competence Goal

The students are able to:

- describe and apply the mathematical and physical principles of chemical reaction engineering models,
- apply the Python software independently and thoroughly to the reactor models,
- develop a reaction engineering model for an unknown chemical process and solve problems of reactor design,
- analyse and evaluate the results obtained by comparing them with current literature,
- recognise and evaluate errors and uncertainties in the model,
- represent, present and critically discuss the results they have obtained in an appropriate form.

Content

1. Introduction to modeling and simulation of chemical reactors
2. Balance equations of chemical reactors
3. Processes in porous systems
4. Homogeneous and heterogeneous reactor models
5. Applied numerical methods
6. Reactor design

Module grade calculation

The module grade is the grade of the examination of another type.

Annotation

Learning control is an examination of another type: The project work is assessed on the basis of the source code, the poster and its presentation.

Workload

- Attendance time: 45 h
- Homework: 105 h
- Exam preparation: 30 h

Recommendation

Knowledge about Chemical Process Engineering I and II is recommended.

Literature

- Finlayson: Introduction to Chemical Engineering Computing; 2012, Wiley
- Jakobsen: Chemical Reactor Modeling; 2014, Springer
- Salmi et al.: Chemical reaction engineering: a computer-aided approach; 2020, de Gruyter

M**6.37 Module: Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids [M-CIWVT-104328]**

Responsible: Dr.-Ing. Bernhard Hochstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage until 9/30/2025)
[Specialized Course I / Applied Rheology](#) (Usage until 9/30/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-----------|
| T-CIWVT-108883 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids | 4 CR | Hochstein |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

Prerequisites

None

Module grade calculation

The module grade is the grade of oral examination.

Annotation

The course is being phased out. The lecture will be offered for the last time in WS 24/25. Examinations can be taken until 30.09.2025.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.38 Module: Control of Distributed Parameter Systems [M-CIWVT-106318]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-112826 | Control of Distributed Parameter Systems | 6 CR | Meurer |

Competence Certificate

Learning control is an oral examination with a duration of about 45 minutes.

Prerequisites

none

Module grade calculation

Modulnote ist die Note der mündlichen Prüfung.

Workload

Attendance time: Lectures: 30 hrs. Exercises: 15 hrs.

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

- T. Meurer: Regelung verteilt-parametrischer Systeme, Vorlesungsskript.
- R. Curtain, H. Zwart: An Introduction to Infinite-Dimensional Linear Systems Theory, Springer-Verlag, 2012.
- M. Krstic, A. Smyshlyaev: Boundary Control of PDEs: A Course on Backstepping Designs, SIAM, 2008.
- Z. Luo, B. Guo, O. Morgül: Stability and Stabilization of Infinite Dimensional Systems with Applications, Springer-Verlag, 2012.
- T. Meurer: Control of Higher-Dimensional PDEs: Flatness and Backstepping Designs, Springer-Verlag, 2012.

M**6.39 Module: Cryogenic Engineering [M-CIWVT-104356]**

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---------------------------------------|------|----------|
| T-CIWVT-108915 | Cryogenic Engineering | 6 CR | Grohmann |

Competence Certificate

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

Prerequisites

None

Competence Goal

Understanding the principle and modelling of regenerative cryocoolers; Understanding and applying of essential engineering methods and components for the conception and design of low-temperature plants and cryostat systems; Understanding of laboratory measurement principles, assessing and applying of sensors and instruments for cryogenic measurement tasks and analysing of measurement uncertainties

Content

Cryogenic applications; Regenerative cooling with cryocoolers; Fundamentals of low-temperature plant and cryostat design, including fluid mechanics and heat transfer, thermal contacts and thermal insulation, cryogenic pumping of gasses, regulations, design components and safety; General principles of measurement and uncertainties as well as cryogenic temperature, pressure and flow measurement

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 45 h
- Exam Preparation: 90 h

M**6.40 Module: Data Analysis and Statistics [M-CIWVT-104345]**

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Gas Particle Systems](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-----------|
| T-CIWVT-108900 | Data Analysis and Statistics | 4 CR | Guthausen |

Competence Certificate

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

Prerequisites

None

Competence Goal

The students are familiar with statistical parameters and are able to judge. Out of the variety of statistical approaches for data analysis they are able to choose the most promising tool for a given question.

Content

Introduction into statistics and its application in data analysis. Descriptive statistics with typical quantities and parameters like standard deviation, distributions and their applications. The application of these tools leads to statistical tests, which are needed in approximation and regression. Chemometric data treatment and statistic processing of large data sets will be studied on the example of multivariate approaches for revealing correlations.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 30 h
- Exam Preparation: 60 h

M**6.41 Module: Data-Based Modeling and Control [M-CIWVT-106319]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-112827 | Data-Based Modeling and Control | 6 CR | Meurer |

Competence Certificate

Learning control is an oral examination with a duration of about 45 minutes.

Prerequisites

none

Content

The module covers basic concepts and fundamentals of data-based approaches for modeling and control design for dynamical systems and processes. Data-based approaches for modeling, also called system identification, are used to identify a mathematical description of the considered system from the available input and output data. Data-based approaches for control design compute the controller without an a priori known model of the system. Extensions to learning-based control are addressed, where in principle machine learning techniques are used to learn a model or a controller for a given system.

Problem sets are considered in the exercises to apply the developed methods.

Module grade calculation

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

Workload

Attendance time: Lectures: 30 hrs. Exercises: 15 hrs.

Self-study: 75 hrs.

Exam preparation: 60 hrs.

Literature

- T. Meurer: Data-based Modeling and Control, Lecture Notes.
- S.L. Brunton, J.N. Kutz: Data-Driven Science and Engineering: Machine Learning, Dynamical Systems, and Control, Cambridge University Press, 2022.
- D. Bertsekas: Reinforcement Learning and Optimal Control, Athena Scientific, 2019.
- D.H. Owens: Iterative Learning Control, Springer, 2016.
- Various recent publications, which will be discussed in lecture.

M**6.42 Module: Data-Driven Process Engineering Models in Python [M-CIWVT-106835]****Responsible:** Dr.-Ing. Frank Rhein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2024)[Specialized Course I / Biopharmaceutical Process Engineering](#) (Usage from 10/1/2024)[Specialized Course I / Mechanical Process Engineering](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-113708 | Data-Driven Models in Python - Process Engineering Project | 3 CR | Rhein |
| T-CIWVT-113709 | Data-Driven Process Engineering Models in Python - Exam | 1 CR | Rhein |

M**6.43 Module: Design of a Jet Engine Combustion Chamber [M-CIWVT-105206]****Responsible:** Dr.-Ing. Stefan Raphael Harth**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2019)[Specialized Course I / Energy Process Engineering](#) (Usage from 10/1/2019)[Specialized Course I / Combustion Technology](#) (Usage from 10/1/2019)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-110571 | Design of a Jet Engine Combustion Chamber | 6 CR | Harth |

Competence Certificate

Learning control is an examination of another type.

The module grade consists of the grade of the oral examination (35 points maximum) and the cooperation / presentation during the project (65 points maximum).

The learning control is passed when at least 45 points are achieved.

Prerequisites

None

Competence Goal

- The students are able to apply the relevant design parameters in order to design a jet engine combustor.
- The students are able to evaluate design modifications due to the performance of a jet engine combustor.
- The students are able to review literature studies and use them for their design aims.
- The students learn to work target oriented following a time schedule.
- The students learn to work in a team and to exchange information between the teams by definition of interfaces.
- The students learn to present clearly and in an acceptable time the work progress and the most important results.

Content

At the beginning the description and operating mode of a jet engine with emphasis on the combustor is explained in 4 lessons. Afterwards the design of the combustor based on geometrical boundary conditions (engine casing) and the performance conditions will start. The tasks to be solved for the design are the combustor aerodynamic (pressure loss, air split), thermal management (temperature distribution, wall cooling, material), calculation of emissions and the construction of the combustor. In order to solve the tasks the students have to be organized in groups which are responsible for the tasks mentioned. The work progress will be controlled by a time schedule and regular presentations. The complete design will be discussed in a final presentation.

Module grade calculation

The module grade is the grade of the examination of another type.

Workload

- Attendance time (Lecture): 30 h
- Homework: 45 h
- Project: 80 h
- Exam Preparation: 45 h

Literature

- Lefebvre, Gas Turbine Combustion
- Rolls-Royce plc, the jet engine
- Müller, Luftstrahltriebwerke Grundlage, Charakteristiken, Arbeitsverhalten

M

6.44 Module: Design of Micro Reactors [M-CIWVT-104286]

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-108826 | Design of Micro Reactors | 6 CR | Pfeifer |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4, subsection 2, number 2, SPO).

Prerequisites

None

Competence Goal

The students are able to apply the methods of process intensification by microstructuring of the reaction zone and are capable of analyzing the advantages and disadvantages while transferring given processes into microreactors. With knowledge of special production processes for micro reactors, students are able to design microstructured systems in terms of heat exchange and to analyze the possibilities of transferring processes from conventional technology into the microreactor with regard to heat transfer performance. They understand also how the mechanisms of mass transport and mixing interact in microstructured flow mixers, and are able to apply this knowledge to the combination of mixing and reaction. They can also analyze possible limitations in the process adaptation and are thus able to design microstructured reactors for homogeneous reactions appropriately. The students understand the significance of the residence time distribution for the conversion and selectivity and are capable of analyzing the interaction of mass transport by diffusion and hydrodynamic residence time in microstructured equipment in given applications.

Content

Basiswissen zu mikroverfahrenstechnischen Systemen: Herstellung von mikrostrukturierten Systemen und Wechselwirkung mit Prozessen, Intensivierung von Wärmetausch und spezielle Effekte durch Wärmeleitung, Verweilzeitverteilung in Reaktoren und Besonderheiten in mikrostrukturierten Systemen, strukturierte Strömungsmischer (Bauformen und Charakterisierung) und Auslegung von strukturierten Reaktoren hinsichtlich Stoff- und Wärmetransport

Workload

Lectures: 45 h

Homework: 42 h

Exam preparation: 60 h (about 1.5 weeks)

Literature

- Skript (Foliensammlung), Fachbücher:
- Kockmann, Norbert (Hrsg.), Micro Process Engineering, Fundamentals, Devices, Fabrication, and Applications, ISBN-10: 3-527-31246-3
- Micro Process Engineering - A Comprehens (Hardcover), Volker Hessel (Editor), Jaap C. Schouten (Editor), Albert Renken (Editor), Yong Wang (Editor), Junichi Yoshida (Editor), 3 Bände, 1500 Seiten, Wiley VCH, ISBN-10: 3527315500
- Winnacker-Küchler: Chemische Technik, Prozesse und Produkte, BAND 2: NEUE TECHNOLOGIEN, Kapitel Mikroverfahrenstechnik S. 759-819, ISBN-10: 3-527-30430-4
- Emig, Gerhard, Klemm, Elias, Technische Chemie, Einführung in die chemische Reaktionstechnik, Springer-Lehrbuch, 5., aktual. u. erg. Aufl., 2005, 568 Seiten, ISBN-10: 3-540-23452-7 (Kapitel Mikroreaktionstechnik S. 444-467)
- Chemical Kinetics, ISBN 978-953-51-0132-1 "Application of Catalysts to Metal Microreactor Systems", P. Pfeifer, <http://www.intechopen.com/books/chemical-kinetics/application-of-catalysts-to-metal-microreactor-systems>

M**6.45 Module: Development of an Innovative Food Product [M-CIWVT-104388]**

Responsible: Dr.-Ing. Ulrike van der Schaaf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each term | 2 terms | German | 5 | 2 |

| Mandatory | | | |
|----------------|--|------|----------------|
| T-CIWVT-108960 | Development of an Innovative Food Product | 3 CR | van der Schaaf |
| T-CIWVT-111010 | Development of an Innovative Food Product - presentation | 3 CR | van der Schaaf |

Competence Certificate

The learning control consists of:

- Seminar/ Presentation
- written elaboration/ exposé

Prerequisites

None

Competence Goal

Students can use their knowledge on food products and their processing to develop an innovative food product of their own. They also can develop a suitable process for its production with regards to energy efficiency and sustainability. Students are able to use basic principles of scale up in the food industry and to use strategies to ensure food quality and safety on a large scale. They can evaluate these concepts regarding their own food product. They understand basic concepts of marketing and packaging technology and can apply those concepts to their innovative product and analyse them. Students can apply basic principles of project management and evaluate them regarding the development of their food product.

Content

Development of a food product consumer ready (aspects included are amongst others food quality and safety, scale up, energy efficiency, sustainability, marketing and packaging); project management

Module grade calculation

50 % presentation (individual grade), 50 % written elaboration (group grade)

Annotation

There is an opportunity to participate in the competition "EcoTrophelia".

The maximum number of participants is limited. Admission is based on a selection interview.

Workload

- Lab work: 100 h
- Homework: 20 h
- Written elaboration: 30 h
- Seminar and presentation: 30 h

M**6.46 Module: Digital Design in Process Engineering [M-CIWVT-105782]**

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2021)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-111582 | Digital Design in Process Engineering - Laboratory | 3 CR | Klahn |
| T-CIWVT-111583 | Digital Design in Process Engineering - Oral Examination | 3 CR | Klahn |

Competence Certificate

The learning control consists of:

1. Laboratory, ungraded according to SPO section 4 subsection 3.
2. Oral examination according to SPO section 4 subsection 2 No. 2.; duration about 30 minutes.

The laboratory is a prerequisite for the oral exam.

Prerequisites

None.

Competence Goal

- Understanding and applying the basics of 3D geometry modeling
- Identification of typical errors and artifacts in 3D models
- Selection of suitable methods for optimization, design and validation

Content

Digital design for Process Engineering introduces tools and methods for efficiently designing parts in process engineering.

- Computer Aided Design CAD (Autodesk Inventor)
- Topology optimization
- Parametric design and design automation (Grasshopper Rhino)
- Workflows of optimization, design and numerical validation

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Lectures and Lab: 60 h
- Homework (CAD-design): 80 h
- Exam preparation: 40 h

Recommendation

The module is recommended as preparation for the module Additive Manufacturing for Process Engineering [M-CIWVT-105407].

M**6.47 Module: Digitization in Particle Technology [M-CIWVT-104973]****Responsible:** Dr.-Ing. Marco Gleiß**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Gas Particle Systems](#)[Specialized Course I / Mechanical Process Engineering](#)[Specialized Course I / Automation and Process Systems Engineering](#)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each winter term**Duration**
1 term**Language**
German**Level**
4**Version**
1

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-110111 | Digitization in Particle Technology | 4 CR | Gleiß |

Competence Certificate

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

Prerequisites

None

Competence Goal

Capability to develop integrated strategies for the digitalization of processes in particle technology. This includes the development of methods but also the application of numerical methods.

Content

Teaching methods for the systematic development of engineering-scientific digitization strategies for particle technology. This includes the mathematical fundamentals of process simulation and model predictive control as well as basics of online and in-situ process analysis. Furthermore, the metrological acquisition of large amounts of data requires complex evaluation methods for further processing and reduction of the generated data. The basics of multivariate data analysis as well as machine learning are taught. The developments in digitalization in particle technology are supported by various practical examples. In addition to the lecture a practical exercise in the form of a project work takes place.

Module grade calculation

The Module grade is the grade of the oral examination.

Workload

- Lecture: 15 h, Exercise: 15 h
- Homework: 60 h
- Exam preparation: 30 h

M**6.48 Module: Dimensional Analysis of Fluid Mechanics Problems [M-CIWVT-104327]****Responsible:** Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage until 9/30/2025)
[Specialized Course I / Applied Rheology](#) (Usage until 9/30/2025)
[Specialized Course I / Gas Particle Systems](#) (Usage until 9/30/2025)
[Specialized Course I / Mechanical Process Engineering](#) (Usage until 9/30/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-----------|
| T-CIWVT-108882 | Dimensional Analysis of Fluid Mechanics Problems | 4 CR | Hochstein |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Annotation

The Course is being phased out. The lecture will be offered for the last time in summer term 2025. Examinations can be taken until 30.09.2025.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.49 Module: Drying Technology [M-CIWVT-104370]**

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Thermal Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|---------|
| T-CIWVT-108936 | Drying Technology | 6 CR | Schabel |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students are able to identify and design a drying process. They will have an overview on the state of the art in drying technology science.

They are able to interpret, evaluate and select a proper drying process.

The qualification goal is to learn proper methods and drying technology basics in order to transfer this fundamental knowledge to new processes and apparatus.

Content

Introduction to drying technology and industrial applications; Modeling of heat mass transfer during drying and modeling of the entire drying process ; Determination of material properties, sorption, diffusion; Determination of typical drying curves and regimes

Fundamentals in polymer film drying and drying of porous materials; Basic principles of spray drying, fluidized bed drying, microwave drying, infrared drying and freeze drying.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 90 h
- Exam Preparation: 45 h

M**6.50 Module: Dynamics of Process Engineering Systems [M-CIWVT-107037]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2025)[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2025)[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-114105 | Dynamics Process Engineering Systems - Prerequisite | 3 CR | Jerono |
| T-CIWVT-114106 | Dynamics of Process Engineering Systems - Exam | 3 CR | Jerono |

Competence Certificate

The Learning control consists of two partial achievements:

1. Examination of another type.
2. Oral examination lasting approx. 45 minutes.

Module grade calculation

The module grade ist the CP-weighted average of the two partial achievements.

Literature

- P. Jerono und T. Meurer: Dynamik verfahrens-technischer Systeme, Vorlesungsskript.
- B. Brogliato, R. Lozano, B. Maschke, O. Egeland: Dissipative systems analysis and control, Springer, 2007.
- S. Strogatz: Nonlinear Dynamics and Chaos: with applications to physics, biology, chemistry, and engineering, Pereus Books.
- J. Hale, H. Kocak: Dynamics and Bifurcations, Springer.
- S. Wiggins: Introduction to Applied Nonlinear Systems and Chaos, Springer.
- S. Sastry: Nonlinear Systems: Analysis, Stability, and Control, Springer.
- S. Stephanopoulos: Chemical process control (Vol. 2), NJ: Prentice hall.

M**6.51 Module: Electrobiotechnology [M-CIWVT-106518]****Responsible:** Prof. Dr.-Ing. Dirk Holtmann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 2 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-113148 | Electrobiotechnology | 4 CR | Holtmann |
| T-CIWVT-113829 | Electrobiotechnology Seminar | 2 CR | Holtmann |

M

6.52 Module: Electrocatalysis [M-ETIT-105883]

Responsible: Prof. Dr. Ulrike Krewer
Dr. Philipp Röse

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: [Technical Supplement Course](#) (Usage from 4/1/2022)
[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 5 | Grade to a tenth | Each summer term | 1 term | English | 4 | 3 |

| Mandatory | | | |
|---------------|----------------------------------|------|------|
| T-ETIT-111831 | Electrocatalysis | 6 CR | Röse |

Competence Certificate

The examination takes place in form of a written examination lasting 120 minutes.

Prerequisites

none

Competence Goal

Students have a well-grounded knowledge of electrocatalytic energy technologies for the conversion and storage of electrical energy in chemicals (Power-to-X). They know the functional principle of state-of-the-art electrocatalysts in fuel cells and electrolysis and understand the underlying electrochemical and physical processes. Participation in the course enables the students to assess and understand the relationship between electrode structure and their selectivity, performance and stability. Furthermore, the students learn the theoretical basics of experimental methods that are relevant for the investigation of model electrodes and technical cells.

Content

Lecture:

- **Basics, concepts and definitions within the Power-to-X context:** Catalysis and electrocatalysis; activity and selectivity; fundamentals of electrochemical processes, elementary steps involving adsorbed intermediates.
- **The role of intermediates:** Electron transfer without intermediates, multi-electron transfer with intermediates; differences in adsorption energies of intermediates and active surfaces
- **Theoretical treatment of electron transfer reactions:** Tunneling processes at electrodes; electron transfer reactions (Marcus theory); role of electrode material on rate of electrode reaction.
- **Measurement methods for the investigation of electrocatalytic reactions:** Determination of the effective surface; Determination of the activity of electrochemically active species; Determination of the selectivity; Operando measurement methods
- **Technically important electrocatalytic reactions and processes:** The oxygen reduction reaction (ORR) and evolution reaction (OER); the chlorine evolution reaction.

Module grade calculation

The module grade is the grade of the written examination.

Workload

attendance in lectures: 30 * 45 min. = 22,5 h

attendance in exercises: 15 * 45 min. = 11,25 h

preparation and follow up of the lectures and practice: 76.25 hours (approx. 1.75 hours per lecture or exercise)

preparation of examination and attendance in examination: 40 h

A total of 150 h = 5 CR

Recommendation

The participation of the module "Electrochemical Energy Technologies" is helpful.

M**6.53 Module: Electrochemistry [M-CHEMBIO-106697]****Organisation:** KIT Department of Chemistry and Biosciences**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2024)**Credits**

3

Grading scale

Grade to a tenth

Recurrence

Irregular

Duration

1 term

Language

German

Level

4

Version

1

Mandatory

| | | | |
|------------------|----------------------------------|------|--|
| T-CHEMBIO-109773 | Electrochemistry | 3 CR | |
|------------------|----------------------------------|------|--|

Prerequisites

None

M**6.54 Module: Energy Technology [M-CIWVT-104293]**

Responsible: Prof. Dr.-Ing. Horst Büchner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|---------|
| T-CIWVT-108833 | Energy Technology | 4 CR | Büchner |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 30 h
- Exam Preparation: 60 h

M**6.55 Module: Engineering Heterogeneous Catalysis [M-CIWVT-107025]****Responsible:** Prof. Dr.-Ing. Gregor Wehinger**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Specialized Course I / Chemical Process Engineering](#) (Usage from 4/1/2025)**Credits**
6**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-114085 | Engineering Heterogeneous Catalysis | 6 CR | Wehinger |

Competence Certificate

Learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time (Lectures and exercises): 45 hrs
- Homework: 75 hrs
- Exam Preparation: 60 hrs

Literature

- Dmitry Yu. Murzin: *Engineering Catalysis*, De Gruyter, Berlin, 2nd Ed. (2020)
- G. Ertl, H. Knözinger, F. Schüth, J. Weitkamp: *Handbook of Heterogeneous Catalysis*, Wiley-VCH, Weinheim (2008)
- I. Chorkendorff and J.W. Niemantsverdriet: *Concepts of modern catalysis and kinetics*, Wiley-VCH, Weinheim, 3rd Ed. (2017)
- A. Jess, P. Wasserscheid: *Chemical technology: an integrated textbook*, Wiley-VCH, Weinheim (2013)

M**6.56 Module: Environmental Biotechnology [M-CIWVT-104320]**

Responsible: Andreas Tiehm
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-106835 | Environmental Biotechnology | 4 CR | Tiehm |

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 45 h
- Exam Preparation: 45 h

M**6.57 Module: Estimator and Observer Design [M-CIWVT-106320]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-112828 | Estimator and Observer Design | 6 CR | Jerono |

Competence Certificate

Learning control is an oral examination with a duration of about 45 minutes.

Content

State feedback control relies on the availability of the full state vector, which is in general not available from measurements. Moreover determining the states (or parameters) of a dynamical systems is of interest on its own as this allows to obtain insights into the system dynamics or to estimate quantities that are not or hardly measurable. The lecture addresses basic concepts of estimation and identification methods and the design of optimal state observers for linear and nonlinear dynamical systems both in a continuous and a discrete time setting. This includes:

- Introduction to fundamental concepts for system identification and state estimation
- State-space approaches for system identification
- Analysis of observability and detectability
- Design of linear and nonlinear observers as well as optimal state estimators (Kalman-Bucy and Kalman Filters)
- Numerical methods

Module grade calculation

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

Workload

Attendance time: Lectures: 30 hrs. Exercises: 15 hrs.

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

- P. Jerono: Estimator and Observer Design, Lecture Notes.
- L. Lennart: System identification. Birkhäuser, 1998.
- H. Nijmeijer, A. Van der Schaft: Nonlinear dynamical control systems, Springer-Verlag, 1990.
- Isidori: Nonlinear Control Systems, Springer-Verlag, 1995.
- Gelb: Applied optimal estimation. MIT Press, 1974.
- F.L. Lewis, X. Lihua, and D. Popa: Optimal and robust estimation: with an introduction to stochastic control theory, CRC Press, 2017.

M**6.58 Module: Extrusion Technology in Food Processing [M-CIWVT-105996]****Responsible:** PD Dr.-Ing. Azad Emin**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2022)[Specialized Course I / Food Process Engineering](#) (Usage from 10/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--|
| T-CIWVT-112174 | Extrusion Technology in Food Processing | 4 CR | |

Competence Certificate

Learning control is an oral exam lasting about 20 minutes.

Prerequisites

None.

Competence Goal

Students will learn the fundamental principles of extrusion technology and its capabilities as well as the reasons behind its wide use by food industry. They will learn how various conventional food products are manufactured using this technology. Students will be able to approach a development of food more systematically by applying the principles of product design. They will also be able to combine and apply what they have learned in other courses/subjects during their studies in a multidisciplinary approach necessary for extruded food design. Students will understand how extrusion technology can be used in targeted ways to open up new opportunities for sustainable food transition.

Content

This course covers the principles of extrusion, the design of extrusion processes, and the formulation of extruded products. Moreover, the course gives an introduction to more fundamental topics such as biopolymer structure, reactivity, rheology and process control. In addition to the extrusion of conventional products, the design of sustainable and innovative food products such as plant-based meat and sea-food alternatives as well as upcycled food side-streams, will be discussed. While focusing on the fundamentals as well as on the state-of-the-art extrusion technology, the course is very practically oriented, and includes a practical demonstration of the principles learned.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 h
- Self-study: 30 h
- Exam preparation: 60 h

Literature

Will be announced.

M**6.59 Module: Flow and Combustion Instabilities in Technical Burner Systems [M-CIWVT-104294]**

Responsible: Prof. Dr.-Ing. Horst Büchner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Combustion Technology](#)

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-108834 | Flow and Combustion Instabilities in Technical Burner Systems | 4 CR | Büchner |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).
The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 30 h
- Exam Preparation: 60 h

M**6.60 Module: Fluid Mechanics of Non Newtonian Fluids [M-CIWVT-104322]**

Responsible: Dr.-Ing. Bernhard Hochstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-----------|
| T-CIWVT-108874 | Fluid Mechanics of Non-Newtonian Fluids | 8 CR | Hochstein |

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 140 h
- Exam Preparation: 40 h

M**6.61 Module: Fluidized Bed Technology [M-CIWVT-104292]**

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Gas Particle Systems](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-108832 | Fluidized Bed Technology | 4 CR | Rauch |

Competence Certificate

The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Understanding of fluidized beds, design and calculation of fluidized beds incl. gas distributors, advantages and disadvantages of fluidized beds and industrial applications

Content

Fundamentals of fluidized beds, explanation of bubbling circulating and dual fluidized beds, calculation of minimum fluidization velocity and transport velocity, classification of particles, design of gas distributors, theory of bubbles in fluidized beds, heat transfer, cold flow models and CFD simulation for design of fluidized beds, industrial examples of fluidized beds

Workload

- Lectures: 30 h
- Homework: 50 h
- exam preparation: 40 h

Literature

- Fluidized Beds, Jesse Zhu, Bo Leckner, Yi Cheng, and John R. Grace, Chapter 5 in Multiphase Flow Handbook. Sep 2005, ISBN: 978-0-8493-1280-9, <https://doi.org/10.1201/9781420040470.ch5>
- Glicksman L.R., Hyre M., Woloshun K., "Simplified scaling relationships for fluidized beds" Powder Technology, 77, (1993)
- Werther, Fluidised-Bed Reactors, in Ullmanns Encyclopedia of industrial chemistry, http://dx.doi.org/10.1002/14356007.b04_239.pub2

M**6.62 Module: Food Chemistry Basics [M-CHEMBIO-104620]**

Responsible: Prof. Dr. Mirko Bunzel
Organisation: KIT Department of Chemistry and Biosciences
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|------------------|---------------------------------------|------|--------|
| T-CHEMBIO-109442 | Food Chemistry Basics | 4 CR | Bunzel |

Prerequisites

None

Workload

- Lectures: 30 h
- Homework: 45 h
- exam preparation: 45 h

M**6.63 Module: Formulation of (Bio)pharmaceutical Therapeutics [M-CIWVT-104266]**

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-108805 | Formulation of (Bio)pharmaceutical Therapeutics | 4 CR | Hubbuch |

Competence Certificate

The examination is an oral examination with a duration of about 15 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

The students will be able to discuss different development routes for the formulation of pharmaceuticals. The implications of different physiologies for the different formulations will be analyzed. Pro's and con's of different formulations and applications are evaluated.

Content

Fundamentals; Development of formulations for pharmaceuticals; Oral, Parenteral, Dermal, Nasal, Pulmonal; Formulation for Biopharmaceuticals

Module grade calculation

The grade of the oral examination is the module grade.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

M**6.64 Module: Fuel Technology [M-CIWVT-104289]****Responsible:** Dr. Frederik Scheiff**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Environmental Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---------------------------------|------|---------|
| T-CIWVT-108829 | Fuel Technology | 6 CR | Scheiff |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are enabled to characterize fuel resources and derived fuels / chemical energy carriers and to critically evaluate the processes for conversion of fuel resources to chemical energy carriers with respect to process technology, economy and ecology

Content

- Overview of fuel resources: coal, oil, gas, biomass – process of formation, resources, consumption
- Mining technology
- Characterization and analysis of fuel resources and fuels
- Basics and processes for conversion of fuel resources into chemical energy carriers / fuels
- Processes of fuel conversion: power / heat, mobility, synthesis
- Tools for critical evaluation of process chains: LCA, ecoefficiency analysis

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

Literature

- "Die Veredlung und Umwandlung von Kohle Technologien und Projekte 1970 bis 2000 in Deutschland"; ISBN 978-3-936418-88-0
- „Grundlagen der Gastechnik“; ISBN 978-3446211094
- "Handbook of Fuels"; ISBN 978-3-527-30740-1
- „Ullmann's Encyclopedia of Industrial Chemistry“; ISBN 978-3-5273-0673-2

M**6.65 Module: Fundamentals of Water Quality [M-CIWVT-103438]****Responsible:** Dr. Michael Wagner**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Water Technology](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-106838 | Fundamentals of Water Quality | 6 CR | Wagner |

Competence Certificate

Learning control is an oral exam lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

Students can explain the relationships behind the occurrence of geogenic and anthropogenic compounds in the hydrological cycle. They are able to select adequate methods for the analysis of water constituents and microorganisms in water samples. They are familiar with the associated calculations, and they can compare and interpret the obtained data. They know how to apply different methods, how to analyze relationships and how to critically assess water quality analyses.

Content

Various types of water, legislations, analytical definitions, analytical quality, sampling methods, quick test methods, field investigations, organoleptic determinations, general investigations, optical characterization (turbidity, color, UV, Lambert-Beer's law, photometry), titrations, acid-base-systems, buffering, main inorganic compounds (anions, cations, occurrence, ion chromatography, titration, complexometry, flame photometry, atomic spectroscopy), heavy metals and metalloids (occurrence and main methods for determination), organic compounds and organic micropollutants (occurrence, thin layer chromatography, high performance liquid chromatography, infrared spectroscopy, gas chromatography), water-specific sum parameters (DOC, AOX, COD, BOD), radioactivity, microbiology.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

Attendance time: 45 h

Preparation/follow-up: 65 h

Examination + exam preparation: 70 h

Literature

- Harris, D.C., 2010. Quantitative chemical analysis. W. H. Freeman and Company, New York.
- Crittenden, J.C. et al., 2005. Water treatment – Principles and design. Wiley & Sons, Hoboken.
- Patnaik, P., 2010. Handbook of environmental analysis: Chemical pollutants in air, water, soil, and solid wastes. CRC Press.
- Wilderer, P., 2011. Treatise on water science, four-volume set, 1st edition, volume 3: Aquatic chemistry and biology. Elsevier, Oxford.
- Lecture notes in ILIAS

M**6.66 Module: Gas Particle Measurement Technology [M-CIWVT-104337]**

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Gas Particle Systems](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-108892 | Gas Particle Measurement Technology | 6 CR | Dittler |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students can independently solve questions concerning gas particle measurement technology by knowledge of the required analysis steps and choice of a particle measurement technology suitable for the task at hand.

Content

Aspects of particle measurement technology; sampling; sample preparation; dispersion; imaging measurement methods; counting methods; separation methods, spectroscopy, gas analysis.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 90 h
- Exam Preparation: 30 h

M**6.67 Module: Gas Particle Separation Processes [M-CIWVT-104340]****Responsible:** Dr.-Ing. Jörg Meyer**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Gas Particle Systems](#)
[Specialized Course I / Mechanical Process Engineering](#)
[Specialized Course I / Environmental Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-108895 | Gas Particle Separation Processes | 6 CR | Meyer |

Competence Certificate

The examination is an oral examination with a duration of about 30 minutes (single examination) or 20 minutes (comprehensive examination in VF Gas-Partikel-Systeme) (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students develop an understanding for the basic physical processes that can be used for the (size dependent) separation of particles from a carrier gas flow, and become acquainted with related types of separation apparatus. They are able to identify the crucial operational and process conditions needed for a preselection of suitable separation devices for a specific separation task. They can describe quantitatively the influence of the main operational and process parameters on separation efficiency and energy consumption of an individual apparatus. The students learn to detect practical problems in the operation of separation devices, and they can identify procedures to overcome these issues.

They are therefore able to independently select the most suitable device and the corresponding operational mode for a specific separation task.

Content

- Fundamentals:
 - Basic quantitative description of separation processes
 - Elementary theory for classifiers and separators
 - Criteria for selection and evaluation of a separation apparatus
 - Legal framework
- Specific separators for gas particle systems:
 - Functionality, design, fields of application, limitations, practical examples
 - Approximate quantitative calculation of separation efficiency and energy consumption for exemplary classification or separation tasks
 - Types of devices that are described in the lecture:
 - Classifiers in gravity and centrifugal force fields
 - Centrifugal separators (gas cyclone)
 - Filtering separators
 - Wet separators (Scrubbers)
 - Electrical separators (Electrostatic precipitators)

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

M**6.68 Module: Heat Exchangers [M-CIWVT-104371]**

Responsible: Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Thermal Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---------------------------------|------|--------|
| T-CIWVT-108937 | Heat Exchangers | 4 CR | Wetzel |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students know essential calculation methods for the dimensioning and verification of heat exchangers and are able to apply them to engineering problems. Students can independently use design methodologies for heat exchangers and perform the necessary calculations of heat transfer coefficients.

Content

types of heat exchangers, mean logarithmic temperature, efficiency-NTU-methodology, cell methodology, design of heat exchangers, heat transfer in typical heat exchanger geometries, compact heat exchangers, microchannel heat exchangers

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 50 h
- Exam Preparation: 40 h

M**6.69 Module: Heat Transfer II [M-CIWVT-103051]**

Responsible: Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Thermal Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 4 |

| Mandatory | | | |
|----------------|----------------------------------|------|--------|
| T-CIWVT-106067 | Heat Transfer II | 6 CR | Wetzel |

Competence Certificate

The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO).
 Module grade is the grade of the oral examination.

Prerequisites

None

Competence Goal

Students can deduce the basic differential equations of thermofluid dynamics and know possible simplifications. They know different analytical and numerical solution methods for the transient temperature field equation in quiescent media and are able to use them actively. Students are able to apply these solution methods independently to other heat conduction problems such as the heat transfer in fins and needles.

Content

Advanced topics in heat transfer:

Thermo-fluid dynamic transport equations, transient heat conduction; thermal boundary conditions; analytical methods (combination and separation of variables, Laplace transform); numerical methods (finite difference and volume methods); heat transfer in fins and needles

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

Literature

- Von Böckh/Wetzel: „Wärmeübertragung“, Springer, 6. Auflage 2015
- VDI-Wärmeatlas, Springer-VDI, 10. Auflage, 2011

M**6.70 Module: High Temperature Process Engineering [M-CIWVT-103075]**

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Thermal Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-106109 | High Temperature Process Engineering | 6 CR | Stapf |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

M**6.71 Module: Hydrogen and Fuel Cell Technologies [M-CIWVT-104296]**

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-108836 | Hydrogen and Fuel Cell Technologies | 4 CR | Trimis |

Competence Certificate

Learning control is an oral examination with a duration of about 20 minutes, SPO section 4, subsection 2.

Prerequisites

None

Competence Goal

- The students are able to identify similarities and differences between different fuel cell systems.
- The students are able to assess different fuel cell systems based on the thermodynamic fundamentals.
- Students can describe chemical and process fundamentals of fuel cell systems and, based on this, name conditions for their use.
- The students are able to name and assess hydrogen production processes.
- The students are able to identify and assess specific problem areas of hydrogen and fuel cell technology.

Content

- Introduction and thermo-dynamic basics
- PEM fuel cells
- Molten carbonate fuel cells (MCFC)
- Solid oxide fuel cells (SOFC)
- Fuel cells for liquid and solid fuels
- Hydrogen as an energy carrier
- Hydrogen production
- Electrolysis
- Steam reforming
- Partial oxidation
- Liquid fuel reforming process
- Conversion/purification of carbon monoxide
- Desulphurization
- Fuel cell systems: peripheral components and integration.

Module grade calculation

The module grade is the grade of oral examination.

Workload

Attendance time: 30 h

Homework: 60 h

Exam Preparation: 30 h

Literature

- Ledjeff-Hey, K.; Mahlendorf, F.; Roes, J.: Brennstoffzellen; Entwicklung, Technologie, Anwendung. C. F. Müller Verlag GmbH, Heidelberg 2001; ISBN 3-7880-7629-1
- Na, Woon Ki: Fuel cells : modeling, control, and applications. CRC Press; Boca Raton u.a. 2010, ISBN 978-1-4200-7161-0
- Vielstich, W.; Lamm, A.; Gasteiger, H.A.: Handbook of Fuel Cells – Fundamentals, Technology and Applications. J. Wiley & Sons, Chichester UK, 2003, ISBN 0-471-49926-9
- Shekhawat, Spivey, Berry: Fuel cells: technologies for fuel processing. Elsevier, Amsterdam, 2011; ISBN 978-0-444-53563-4
- Hoogers, G (editor): Fuel Cell Technology Handbook. CRC Press, Boca Raton, London; 2003; ISBN: 0-8493-0877-1
- U.S. Department of Energy: Fuel Cell Handbook. 7th edition 2004. <http://www.netl.doe.gov/File%20Library/research/coal/energy%20systems/fuel%20cells/FCHandbook7.pdf>

M**6.72 Module: Hydrogen in Materials – Exercises and Lab Course [M-MACH-107278]**

Responsible: Dr. rer. nat. Stefan Wagner
Organisation: KIT Department of Mechanical Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each term | 1 term | German | 4 | 1 |

Election notes

The module can be passed either in English or in German.

| Hydrogen in Materials – Exercises and Lab Course (Election: at least 4 credits) | | | |
|---|--|------|--------|
| T-MACH-112159 | Hydrogen in Materials – Exercises and Lab Course | 4 CR | Wagner |
| T-MACH-112942 | Hydrogen in Materials – Exercises and Lab Course | 4 CR | Wagner |

Competence Certificate

The assessment consists of a certificate

Prerequisites

none

Competence Goal

In this exercise with lab course the contents of the lecture “Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement” are deepened. The students know the differences in thermodynamics and kinetics of the hydrogen interaction with storage materials and construction materials. The students can describe the hydrogen interaction with microstructural defects in materials, and they know the resulting effects on the materials’ mechanical integrity. Based on this, the students can express the requirements of the respective materials classes and transfer them to engineering applications.

Utilizing proper experimental setups, the students can measure hydrogen induced stresses in materials, the hydrogens’ diffusivity and its chemical potential, and they can quantify H-effects on the mechanical properties of steels. From the measurement data, the students can construct metal-hydrogen phase diagrams, they can qualitatively assess the defect density in the metal, and they can estimate the susceptibility of steels to hydrogen embrittlement.

Content

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

Workload

The workload for the module “Hydrogen in Materials – Exercises and Lab Course” is 120 h per semester and consists of the presence during the lectures (26 h) as well as self-study for the lecture (94 h).

Learning type

Tutorials (Obligatory)
 Lab Course (Obligatory)

M**6.73 Module: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [M-MACH-107277]**

Responsible: Prof. Dr. Astrid Pundt
Organisation: KIT Department of Mechanical Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each term | 1 term | German | 4 | 1 |

Election notes

The module can be passed either in English or in German.

| Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement (Election: at least 4 credits) | | | |
|---|--|------|-------|
| T-MACH-110923 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | 4 CR | Pundt |
| T-MACH-110957 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | 4 CR | Pundt |

Competence Certificate

oral exam, about 25 minutes

Prerequisites

none

Competence Goal

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

Content

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

Workload

The workload for the module "Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement" is 120 h per semester and consists of the presence during the lectures (26 h) as well as self-study for the lecture (94 h).

Learning type

Lectures (Obligatory)

M**6.74 Module: Industrial Aspects in Bioprocess Technology [M-CIWVT-105412]****Responsible:** Prof. Dr. Jürgen Hubbuch**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Specialized Course I / Biopharmaceutical Process Engineering](#)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
5**Version**
1

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-110935 | Industrial Aspects in Bioprocess Technology | 4 CR | Hubbuch |

Competence Certificate

The examination is an oral examination with a duration of about 15 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students can discuss and analyze challenges and aspects in the biopharmaceutical industry.

Content

- Industrial Aspects on process development.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Lectures: 30 h
- Homework: 60
- Exam preparation: 30

M

6.75 Module: Industrial Biocatalysis [M-CIWVT-106678]**Responsible:** PD Dr. Jens Rudat**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** **Specialized Course I / New Bio-Production Systems - Electro-Biotechnology** (Usage from 4/1/2024)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

| Mandatory | | | |
|----------------|-------------------------|------|-------|
| T-CIWVT-113432 | Industrial Biocatalysis | 4 CR | Rudat |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

The students are enabled to critically compare and evaluate different processes leading to industrially relevant products (chemo- vs. biocatalysis as well as various biocatalytic procedures among each other).

Content

Current developments of enzyme-catalyzed production as well as already established procedures:

- Pharma industries (synthesis and modification of drugs)
- Food and feed industries (enzymatic conversion of ingredients, production of flavour enhancers)

In addition to the presentation of enzymatic reactions and their molecular-biological optimization, also aspects of process engineering are discussed such as choice and design of solvents/reaction media, downstream processing, as well as economic and ecologic factors.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 hrs
- Homework: 45 hrs
- Exam Preparation: 45 hrs

Recommendation

Basic knowledge of biochemistry and enzyme technology is required.

Fundamentals:

Jaeger, Liese, Syltatk: Introduction to Enzyme Technology; SpringerSpektrum 2024; ISBN: Softcover 978-3-031-42998-9 eBook 978-3-031-42999-6

Als PDF frei herunterladbar auf der Seite des Verlags:

<https://link.springer.com/book/10.1007/978-3-662-57619-9>

Literature

Recent publications in relevant journals,

e.g. Angew Chem Int Ed, ChemSusChem, Appl Microbiol Biotechnol

M

6.76 Module: Industrial Bioprocesses [M-CIWVT-106501]**Responsible:** Prof. Dr.-Ing. Michael-Helmut Kopf**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** **Technical Supplement Course** (Usage from 10/1/2023)**Specialized Course I / Biopharmaceutical Process Engineering** (Usage from 10/1/2023)**Specialized Course I / Mechanical Process Engineering** (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|-------------------------|------|------|
| T-CIWVT-113120 | Industrial Bioprocesses | 4 CR | Kopf |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes.

Prerequisites

None

Competence Goal

The Students:

- get familiar with processes and techniques to develop industrial scale, biotech-based processes
- gain insight into the workflow of large scale (double-digit kt/a) industrial bioprocess development
- learn to combine theoretical understanding with practical applications related to relevant industrial systems.

understand relevance of techno-economic evaluation as a basis for developing competitive processes

Content

- **Process to develop new or alternative, bio-based production process:**
Ideation, Basic Concept, Critical analysis, Development steps
- **Value Proposition of novel product / process:**
Quality, Performance, Price, Eco-efficiency, Regional aspects
- **Critical aspects along the development process:**
Feedstock issues, Design to Cost, Specification and Performance, Regulatory Issues, Eco-efficiency (raw material and energy efficiency)
- **From Lab to Production (focus of lecture):**
Phases of a development process: Explorative Research, Proof of Principle, Proof of Concept, Scale-up and Apparatus design, Plant design, Production
- **Competitor Intelligence:**
Competitors with their "own" processes, Alternative products, similar in application
- **Benchmarking as a development tool:**
Cost Benchmarking, CoP, as a development tool to identify optimization potential
- **Production scenarios:**
Own investment, Toller, Production Partner

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

Literature

Skriptum zur Vorlesung

M

6.77 Module: Industrial Wastewater Treatment [M-CIWVT-105903]**Responsible:** Prof. Dr. Harald Horn**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 4/1/2022)
[Specialized Course I / Water Technology](#) (Usage from 4/1/2022)
[Specialized Course I / Environmental Process Engineering](#) (Usage from 4/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|------|
| T-CIWVT-111861 | Industrial Wastewater Treatment | 4 CR | Horn |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Competence Goal

The students will be able to differentiate the composition of different types of industrial wastewater. Moreover, the students will have knowledge of treatment technologies, which can be applied to industrial wastewater. The students will be able to judge the biodegradability of industrial wastewater and can use that to design the needed treatment trains. The students do know treatment steps, which can be used enhance reuse the treated wastewater.

Content

This module provides the huge range of industrial wastewater composition for different industries (food, pulp and paper, chemical and pharmaceutical industry). The biodegradability will be analyzed and discussed with respect to potential treatment systems. A main focus will be biological treatment systems, especially biofilm reactors. Finally, the potential of water reuse in industrial processes will be discussed and solution will be provided.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 h
- self-study: 60 h
- exam preparation: 30 h

Literature

- Horn, H. et al. (2017) Wastewater, 1. Introduction, Ullmann's Encyclopedia of Industrial Chemistry, Wiley-VCH Verlag GmbH & Co. KGaA.
- Telgmann, L., et al. (2019) Wastewater, 2. Aerobic Biological Treatment. Ullmann's Encyclopedia of Industrial Chemistry, Wiley-VCH Verlag GmbH & Co. KGaA.
- Rosenwinkel K.H. et al. (2020) Taschenbuch der Industrieabwasserreinigung, Vulkan Verlag.

M**6.78 Module: Innovation Management for Products & Processes in the Chemical Industry [M-CIWVT-104397]**

Responsible: Dr. Claudius Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German/English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-108980 | Innovation Management for Products & Processes in the Chemical Industry | 4 CR | Neumann |

Competence Certificate

Learning control is a written examination (multiple choice) lasting 60 minutes.

Prerequisites

None

Competence Goal

The students get to know the structures of the chemical industry.

They receive an insight into the interpretation of business figures and their connection with innovations.

They know how different factors influence innovation strategies.

They get to know the expiry of an innovation process.

The students have the opportunity to utilize the presented methods and tackle problems which are close to industrial application.

Besides the students receive an insight into the work of an innovation management (excursion).

Content**Background**

The chemical industry had to adapt to the economic conditions of globalization during the last decades. It has been aligned to global markets thus changing the formerly scientific-technology oriented R&D. Today the work in industrial product & process development requires skills besides a thorough knowledge about chemistry and technology: a good general economic understanding combined with the competence to manage a complex system based on business figures. This competence allows scientifically and technology educated scientists and engineers to align chemical product and process development within the Innovation Strategy to the strategic business plan. It is implemented within the Innovation Process and monitored and managed by characteristic performance indicators. Thus, the economic benefit of innovation can be quantified using quantitative measures.

Scope of the lecture

The lecture intends to provide the fundamentals for understanding Innovation Management and to utilize them by tackling examples close to industrial application. The course addresses the following key questions:

What are the structures in the chemical industry?

What are business figures? How are they interpreted and applied in terms of innovation?

What are customers? How do they influence innovation?

How do marketing and product management determine innovation?

What is a business strategy? How is it connected to the innovation strategy?

What is the Innovation Process? How is it managed?

What is Innovation Portfolio Management? Why is it needed for successful innovation?

What are state of the art Innovation Management practices in the chemical industry?

Visit

The lecture includes a one day visit to the Evonik Site Hanau for experiencing current Innovation Management practices from discussions with managers in the chemical industry.

Module grade calculation

The module grade is the grade of the written exam.

Workload

- Attendance time (Lecture): 30 h (Block lectures 4 days)
- Homework: 60 h
- Exam Preparation: 30 h

M**6.79 Module: Innovative Concepts for Formulation and Processing of Printable Materials [M-CIWVT-105993]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2022)
[Specialized Course I / Applied Rheology](#) (Usage from 10/1/2022)
[Specialized Course I / Entrepreneurship in Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------------|
| T-CIWVT-112170 | Innovative Concepts for Formulation and Processing of Printable Materials | 4 CR | Willenbacher |

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None.

Competence Goal

Students will be able to explain and apply basic concepts of stability and flow behavior of disperse systems. They will learn about industrially important printing and coating processes and be able to design complex fluid systems for these processes. Emphasis will be on printable ceramic and electrically or thermally conductive materials. Students will understand the concept of capillary suspensions and its potential applications for product design and be able to apply it to practical examples.

Content

- Fundamentals of the stability of disperse systems - suspensions and emulsions
- Fundamentals of rheology of disperse systems
- Rheology in printing and coating technology
- Screen printing for electronics and solar cells
- Atomization and automotive coating
- Extrusion-based additive manufacturing (AM) - ceramics, silicone, bio-gels
- Paste formulation concepts based on capillary suspensions
- Conductive adhesives and pastes for printed electronics

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 h
- Self-study: 50 h
- Exam preparation: 40 h

Literature

Colloid Science, Terence Cosgrove, Wiley, 2010, Scientific publications on the individual chapters will be announced in the lecture.

M**6.80 Module: Internship [M-CIWVT-104527]**

Responsible: Dr.-Ing. Siegfried Bajohr
Dr.-Ing. Barbara Freudig

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Internship](#)

Credits
14

Grading scale
pass/fail

Recurrence
Each term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|----------------------------|-------|-----------------|
| T-CIWVT-109276 | Internship | 14 CR | Bajohr, Freudig |

Workload

12 weeks (420 h - 480 h)

M**6.81 Module: Introduction to Numerical Simulation of Reacting Flows [M-CIWVT-106676]**

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Fuel Technology](#) (Usage from 10/1/2025)
[Specialized Course I / Energy Process Engineering](#) (Usage from 10/1/2024)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 10/1/2024)
[Specialized Course I / Combustion Technology](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each winter term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-113435 | Introduction to Numerical Simulation of Reacting Flows - Prerequisite | 5 CR | Stein |
| T-CIWVT-113436 | Introduction to Numerical Simulation of Reacting Flows | 3 CR | Stein |

Competence Certificate

The learning control consists of two partial achievements:

1. Completed Coursework: As a prerequisite for the oral exam, reports on the tutorial have to be submitted. These document the processed task, the generated data and their analysis.
2. Oral examination lasting approx. 30 minutes.

Prerequisites

None

Competence Goal

Course participants know the fundamentals of both batch and flow reactors for the simulation of chemical kinetics and reacting flows. They are knowledgeable of numerical methods for temporal and spatial discretisation. In the related Python tutorials, they have obtained a first practical experience in setting up, running and post-processing chemical kinetics and reacting flow simulations, forming the basis for more advanced simulations.

Content

- Introduction to Python
- batch reactors for chemical kinetics simulations
- simple flow reactors
- Newton-Raphson method
- time and space discretisation

Module grade calculation

The module grade ist the grade of the oral exam.

Annotation

The Python tutorials will be conducted on the students' laptops.

Workload

- Attendance time
Lectures 2 SWS: 30 hrs
Tutorials 2 SWS: 30 hrs
- Self-study
Preparation and wrap-up lectures: 15 hrs
Data analysis, preparation and submission of reports: 105 hrs
- Exam preparation:
60 hrs

M**6.82 Module: Introduction to Sensory Analysis [M-CIWVT-105933]****Responsible:** Dr. Heike Hofsäß**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2022)[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2022)**Credits**
2**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1**Mandatory**

| | | | |
|----------------|--|------|--------|
| T-CIWVT-109128 | Introduction to Sensory Analysis with Practice | 2 CR | Hofsäß |
|----------------|--|------|--------|

M**6.83 Module: Journal Club - Novel Bioproduction Systems [M-CIWVT-106526]****Responsible:** Prof. Dr.-Ing. Dirk Holtmann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2024)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German/English**Level**
5**Version**
1

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-113149 | Journal Club - Novel Bioproduction Systems | 4 CR | Holtmann |

M**6.84 Module: Kinetics and Catalysis [M-CIWVT-104383]**

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(CIW\)](#)
[Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-106032 | Kinetics and Catalysis | 6 CR | Wehinger |

Competence Certificate

Learning control is a written examination lasting 60 minutes.

Prerequisites

None

Competence Goal

Students are introduced to the kinetics of molecular transport and reaction. They learn about catalysis as a kinetic phenomenon. They are able to analyze and interpret the kinetics of homogeneously, enzymatically and heterogeneously catalyzed processes.

Content

Kinetic theory of gases; molecular transport in gases and liquids; diffusivity in porous solids; molecular interactions and Lennard-Jones potential; kinetics of homogeneous reactions; adsorption at solid surfaces and sorption kinetics; elements of the kinetics of catalyzed reactions (homogeneous acid-base, enzymatic and heterogeneous catalysis).

Module grade calculation

The module grade is the grade of the written exam.

Workload

- Attendance time (Lecture): 42 h
- Revision course: 28 h
- Homework: 80 h
- Exam Preparation: 30 h

Literature

- W. Atkins: Physical Chemistry (Oxford University Press, 1998);
- B. Bird, W.E. Stewart, E.N. Lightfoot: Transport Phenomena (Wiley, 2007)
- C. Gates: Catalytic Chemistry (Wiley, 1992)
- Ertl: Reactions at Solid Surfaces (Wiley, 2009)

M**6.85 Module: Liquid Transportation Fuels [M-CIWVT-105200]****Responsible:** Prof. Dr. Reinhard Rauch**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Environmental Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 5 | 2 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-111095 | Liquid Transportation Fuels | 6 CR | Rauch |

Competence Certificate

Learning Control is an oral examination with a duration of about 20 minutes (SPO section 4 subsection 2).

Prerequisites

None

Competence Goal

The students are enabled to balance modern processes for the production of liquid fuels and to put them into context of a modern refinery. Actual alternative processes for the production of liquid fuels, their advantages and disadvantages have to be understood.

Content

Introduction to Chemical Fuels (resources, global and regional consumption, CO₂ emissions, characterization of raw materials and products, overview of conversion processes; petroleum refining: characterization of crude oils and refinery products, physical separation processes, chemical conversion processes (cracking, hydrotreating, reforming, H₂ production etc); liquid fuels from renewable sources (biomass, renewable electricity); gaseous fuels; gasification of solid fuels; economic aspects and perspectives.

Module grade calculation

Grade of the Module ist the grade of oral examination.

Workload

- Lectures and Exercises: 45 h
- Homework: 75 h
- Exam preparation: 60 h

Literature

- Elvers, B. (Ed.): Handbook of Fuels, Energy Sources for Transportation, Wiley VCH 2008.
- Lucas, A. G. (Ed.): Modern Petroleum Technology, Vol. 2 Downstream, John Wiley 2000.
- Gary, J.; Handwerk, G., Kaiser, M. J.: Petroleum Refining, Technology and Economics, Fifth Edition, CRC Press 2007

M

6.86 Module: Mass Transfer II [M-CIWVT-104369]

Responsible: Dr.-Ing. Benjamin Dietrich
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Thermal Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|----------------------------------|------|----------|
| T-CIWVT-108935 | Mass Transfer II | 6 CR | Dietrich |

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes.

Prerequisites

None

Competence Goal

Students will be able to derive the mass transport equation and derive an analytical solution to describe diffusion in stagnant fluid layers, taking various simplifications into account. They will also be able to determine diffusion coefficients for different types of systems. Students will be able to independently formulate the basic scientific equations for selected advanced and practically relevant mass transfer cases and solve them analytically or numerically.

Content

Advanced topics of mass transfer: numerical and analytical methods for solving the mass transfer equation; estimation of diffusion coefficients; in-depth understanding of practically relevant mass transfer cases: Membrane diffusion, mixture evaporation, physical and chemical absorption, mass transfer in complex network structures (lecture contents are accompanied by practical events in the form of numerical simulation studies in OpenFoam and selected practical experiments in the laboratory with elaboration in a team).

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

M**6.87 Module: Materials and Processes for Electrochemical Storage [M-CIWVT-104353]**

Responsible: Prof. Dr. Jens Tübke
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each term | 1 term | German | 4 | 2 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-108146 | Materials and Processes for Electrochemical Storage | 4 CR | Tübke |

Competence Certificate

The examination is an oral examination with a duration about 30 minutes.

Prerequisites

None

Competence Goal

The students know how electrochemical storage devices and converters (batteries and fuel cells) work and the basic electrochemical principles required for this. They are familiar with active and passive materials used, know how these can be manufactured and, if necessary, modified. They will be familiar with process engineering methods for the manufacture of battery cells and fuel cell stacks and know how overall systems are constructed.

Content**Electrochemical basics**

Basic introduction to electrochemistry, electrochemical potentials, concentration dependence, electrochemical methods.

Basics of electrochemical storage systems and fuel cells.

Structure and operation of primary and secondary batteries:

Alkali-manganese, zinc-carbon, lead-acid, zinc-air, nickel-cadmium, nickel-metal hydride, redox-flow batteries, high-temperature batteries, lithium (sodium)-ion batteries, lithium-sulfur batteries, solid-state batteries.

Design and operation of fuel cells:

PEMFC, AMFC, DMFC, SOFC, MCFC.

Materials and processes for electrochemical storage systems

Intercalation and conversion electrodes, liquid, polymeric and ceramic separators (electrolytes),

Electrolyte additives and electrode coatings,

current collector materials (metals, modified plastics), housing materials

catalyst and membrane materials for fuel cells, stack design and materials used in fuel cells

Production methods and processes for manufacturing battery cells and fuel cell stacks

Design principles and production processes for water-based battery systems (lead-acid, nickel-metal hydride)

Design principles and production processes for lithium-based battery systems and solid-state batteries,

Electrode production (paste production, coating process, drying process), dry coating process,

Production processes for separation foils for different battery systems

Quality assurance processes in cell production, cell forming and testing processes for cells

Manufacturing processes for stack components for fuel cells

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 80 h
- Exam Preparation: 10 h

M**6.88 Module: Measurement Techniques in Chemical Processing [M-CIWVT-104490]**

Responsible: Dr.-Ing. Steffen Peter Müller
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
5

Version
1

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-109086 | Measurement Techniques in Chemical Processing | 4 CR | Müller |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students are capable to discuss various measurement methods and are able to compare and analyse different measurement principles.

Due to the mentioned aims, students are able to criticise and rate various measurement methods.

Content

Theory and practice of online measurement methods e.g.: pressure, temperature, pH value and material properties for example: density.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 22,5 h
- Homework: 26 h
- Exam Preparation: 80 h

M**6.89 Module: Measurement Techniques in Chemical Processing (including practical course) [M-CIWVT-104450]**

Responsible: Dr.-Ing. Steffen Peter Müller
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
5

Version
1

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-109086 | Measurement Techniques in Chemical Processing | 4 CR | Müller |
| T-CIWVT-109181 | Practical Course Measurement Techniques in Chemical Processing | 2 CR | Müller |

Competence Certificate

The examination consists of:

1. Oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).
2. Ungraded Laboratory work (section 4 subsection 3 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to discuss various measurement methods and are able to compare and analyse different measurement principles.

Due to the mentioned aims, students are able to criticise and rate various measurement methods.

Content

Theory and practice of online measurement methods e.g.: pressure, temperature, pH value and material properties for example: density.

Workload

- Attendance time (Lecture): 22,5 h
- Internship: 11.5 h, 8 attempts
- Homework: 26 h
- Exam Preparation: 120 h

M**6.90 Module: Measurement Techniques in the Thermo-Fluid Dynamics [M-CIWVT-104297]**

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Thermal Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 10/1/2023)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-108837 | Measurement Techniques in the Thermo-Fluid Dynamics | 6 CR | Trimis |

Competence Certificate

Learning Control is an oral examination with a duration of about 20 minutes (section 4 subsection 2 SPO).

Prerequisites

None

Competence Goal

- The students are able to plan an experiment, select the appropriate quantities to be measured and identify the appropriate dimensionless numbers for the universal representation of the results.
- The students have a thorough understanding of several advanced measuring techniques used for basic research in thermofluids. They are able to select the most appropriate technique for an experimental study.
- The students can assess the accuracy and limitations of measuring techniques quantitatively.
- The students understand the different time scales of involved phenomena and the stochastic nature of experiments, measuring techniques and turbulent flows. They are able to accurately process acquired measurement data in the time and in the spectral domain.

Content

- Design of experiment and dimensional analysis
- Flow visualization (light sheet techniques, shadowgraphy, Schlieren and interferometry)
- Laser Doppler Anemometry
- Phase Doppler Anemometry
- Particle Image Velocimetry
- Laser Induced Fluorescence
- Absorption spectroscopy
- Overview of further techniques
- Data processing for turbulent flows in the time and spectral domain

Module grade calculation

Grade of the module is the grade of the oral examination.

Workload

- Lectures and Exercises: 45 h
- Homework: 25 h
- Exam Preparation: 110 h

Literature

- C. Tropea, Handbook of Experimental Fluid Mechanics, Springer, Heidelberg, 2007
- M. Zlokarnik, Dimensional Analysis and Scale-up in Chemical Engineering, Springer, Berlin, 1991
- A. C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, Taylor & Francis Ltd, New York, 1996
- K. Kohse-Höinghaus, J. B. Jeffries, Applied Combustion Diagnostics, Taylor & Francis Ltd, New York, 2002
- H. W. Coleman, W. G. Steele, Experimentation and Uncertainty Analysis for Engineers, Wiley, New York, 1999

M**6.91 Module: Membrane Materials & Processes Research Masterclass [M-CIWVT-106529]**

Responsible: Prof. Dr. Andrea Schäfer
Organisation: KIT Department of Chemical and Process Engineering
Part of: **Technical Supplement Course** (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-113153 | Membrane Materials & Processes Research Masterclass | 6 CR | Schäfer |

Competence Certificate

Learning control is an examination of another type:

The exam will be composed of contributions during the course and an oral presentation during the full day workshop.

Prerequisites

None

Competence Goal

The student will learn basic skills in research at the example of membrane materials and processes applied to water treatment. The skills will assist in conducting research at master, PhD, or postdoctoral levels when background or training differ. Technical skills include the design of experiments to answer specific research questions, performance parameters through to data manipulation, validation, error estimation and interpretation, while the soft skills encompass health and safety aspects of experimental research, research communication (publication) and research integrity.

Content

The content teaches required knowledge to carry out research in the field, including formulation of a research problem and research questions, experimental design, data validation and storage, as well as presentation of research in spread sheets, graphs, schematics and communication in publications, oral & poster presentations.

Module grade calculation

The module grade is the grade of the examination of another type.

Annotation

The course will be held at IAMT at Campus North (352, IAMT Seminar Room) and be integrated with ongoing research in an international environment. To carry out experimental work exam registration is required. Attendance is required for the completion of the module, in particular for the full day workshop.

Workload

- Lectures and Exercises: 60 hrs
- Self-study: 80 hrs
- Exam preparation: 40 hrs

Recommendation

The course assumes basic knowledge of membrane materials and processes applied to water treatment as well as the course on proposal writing. Those missing the relevant background are expected to read a textbook from the course recommended reading list or consult relevant materials on the proposal writing course.

M**6.92 Module: Membrane Technologies in Water Treatment [M-CIWVT-105380]**

Responsible: Prof. Dr. Harald Horn
Dr.-Ing. Florencia Saravia

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Advanced Fundamentals \(BIW\)](#) (Usage from 4/1/2021)
[Technical Supplement Course](#) (Usage from 4/1/2020)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2020)
[Specialized Course I / Water Technology](#) (Usage from 4/1/2020)
[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2020)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 5 | 3 |

| Mandatory | | | |
|----------------|--|------|---------------|
| T-CIWVT-113235 | Exercises: Membrane Technologies | 1 CR | Horn, Saravia |
| T-CIWVT-113236 | Membrane Technologies in Water Treatment | 5 CR | Horn, Saravia |

Competence Certificate

The learning control consists of two partial achievements:

- written examination lasting 90 minutes
- completed coursework (prerequisite for the written exam):
Submission of exercises, membrane design and short presentation (5 minutes, group work).

Prerequisites

None

Competence Goal

Students have a fundamental knowledge on membrane technology in water and waste water treatment. They learn how the different membrane systems (reverse osmosis, nanofiltration, ultrafiltration, microfiltration, and dialysis) have to be applied to produce a certain water quality. They are able to design such systems.

Content

- The solution-diffusion model
- Concentration polarization and the consequences for membrane module design.
- Membrane production and properties.
- Membrane configuration and design
- Membrane systems for desalination and brackish water treatment
- Membrane bio reactors for waste water treatment
- Biofouling, scaling and prevention of both
- Excursions with introduction

Module grade calculation

The module grade is the grade of the written examination.

Workload

- Attendance time: Lectures: 30 hrs; Exercises/ excursions: 15 hrs
- Preparation/follow-up: 60 hrs
- Examination + exam preparation: 75 hrs

Recommendation

Module „Water Technology (PA221)“

Literature

- Melin, T., Rautenbach, R., 2007. Membranverfahren - Grundlagen der Modul- und Anlagenauslegung. Springer Verlag Berlin Heidelberg.
- Mulder, M.H., 2000. Basic Principles of Membrane Technology. Kluwer Academic, Dordrecht.
- Schäfer, I. A., Fane, A. G. (Eds., 2021): Nanofiltration: Principles and Applications., 2. Edition, Elsevier, Oxford.
- Staude, E., 1992. Membranen und Membranprozesse. Verlag Chemie, Weinheim.
- Vorlesungsunterlagen in ILIAS

M**6.93 Module: Microbiology for Engineers [M-CIWVT-104319]**

Responsible: Prof. Dr. Thomas Schwartz
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Water Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-106834 | Microbiology for Engineers | 4 CR | Schwartz |

Prerequisites

None

Workload

- Attendance time (Lecture): 30 h
- Homework: 50 h
- Exam Preparation: 40 h

M**6.94 Module: Microfluidics [M-CIWVT-104350]**

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 3 |

| Mandatory | | | |
|----------------|-------------------------------|------|----------|
| T-CIWVT-108909 | Microfluidics | 4 CR | Leneweit |

Competence Certificate

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

Prerequisites

None

Competence Goal

Acquisition of capacities for the development of microfluidic systems and their investigation

Content

Definition of the term „microfluidics“, physics of miniaturization, scales in micro and nanofluidics, introduction to fabrication methods, fluid dynamics of microfluidic systems, basic equations of fluid mechanics, creeping flows, electrohydrodynamics of microsystems, electroosmosis, electrophoresis and DNA sequencing, diffusion, mixing and separation in microsystems, interfacial phenomena and multiphase flows in microsystems, digital microfluidics and microfluidic systems, Microfluidic production of mRNA lipid nanoparticles, process engineering research on advanced drug delivery systems

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

Literature

Skriptum zur Vorlesung

M**6.95 Module: Microfluidics and Case Studies [M-CIWVT-105205]**

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-108909 | Microfluidics | 4 CR | Leneweit |
| T-CIWVT-110549 | Microfluidics - Case Studies | 2 CR | Leneweit |

Competence Certificate

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

Prerequisites

None

Competence Goal

Acquisition of capacities for the development of microfluidic systems and their investigation

Content

Definition of the term „microfluidics“, physics of miniaturization, scales in micro and nanofluidics, introduction to fabrication methods, fluid dynamics of microfluidic systems, basic equations of fluid mechanics, creeping flows, electrohydrodynamics of microsystems, electroosmosis, electrophoresis and DNA sequencing, diffusion, mixing and separation in microsystems, interfacial phenomena and multiphase flows in microsystems, digital microfluidics and microfluidic systems

Lab experiments: Preparation of nanoemulsions from aerosols in a micromixer; preparation and characterization of nanocapsules as drug delivery systems by nanofluidics.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 35 h
- Case Studies: 60 h

Literature

Skriptum zur Vorlesung

M**6.96 Module: Microrheology and High Frequency Rheology [M-CIWVT-104395]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)

Credits
2

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|---|------|--------------|
| T-CIWVT-108977 | Microrheology and High Frequency Rheology | 2 CR | Oelschlaeger |

Prerequisites

None

Workload

- Attendance time (Lecture): 15 h
- Homework: 35 h
- Exam Preparation: 10 h

M**6.97 Module: Mixing, Stirring, Agglomeration [M-CIWVT-105399]****Responsible:** Dr.-Ing. Frank Rhein**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 4/1/2020)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2020)
[Specialized Course I / Applied Rheology](#) (Usage from 4/1/2020)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2020)
[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2020)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-110895 | Mixing, Stirring, Agglomeration | 6 CR | Rhein |

Competence Certificate

Learning control is an oral individual examination with a duration of 30min according SPO section 4, subsection 2.

Prerequisites

None

Competence Goal

The students are able to explain the fundamental laws and the derived physical principles of mixing, stirring and the particle agglomeration and not only to relate them to the principally suited processes but also to selected apparatuses. They have the ability to apply the relationship between product, operation and design parameters to different processes. They can analyse the related process engineering problems with scientific methods and give alternative problem solution proposals. On the basis of their skills they can evaluate whether and if applicable a promising process can be designed.

Content

- Fundamentals and applications
- statistic methods to characterize the mixing quality
- characterisation of the flow properties of bulk solids and liquids
- introduction into dimension analysis to achieve characteristic numbers important for mixing problems
- scale-up procedures for specific mixing processes
- solids mixing processes like free-fall, pusher and intensive mixers, fluidised bed, air jet, and turnover mixers; pile mixing techniques
- fluid-mixing processes like homogenisation, suspending, emulsifying, gassing and heat transfer
- static mixers and kneaders
- adhesion forces between particles
- agglomerate properties: characterisation of agglomerates regarding size, size distribution, porosity, density, stability, flow behaviour and instantiation behavior
- agglomeration processes like roll-agglomeration, mixing agglomeration, fluidized bed and spray agglomeration, agglomeration in liquids by means of coagulation, flocculation or changed wettability, press agglomeration by means of tableting, roller compaction or extrusion and post hardening of agglomerates by means of sintering
- Introduction to modeling and simulation of mixing and agglomeration processes

Module grade calculation

The module grade ist the grade of oral examination.

Workload

Lectures: 3 SWS/ 45 h

Homework: 75 h

Exam preparation: 60 h

Total: 180 h

M

6.98 Module: Modeling Wastewater Treatment Processes [M-BGU-106113]**Responsible:** Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|--------------|---|------|------------------|
| T-BGU-112371 | Modeling Wastewater Treatment Processes | 6 CR | Azari Najaf Abad |

Competence Certificate

- 'Teilleistung' T-BGU-112371 with examination of other type according to § 4 Par. 2 No. 3

details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

The students will be able to learn the basics of wastewater treatment modeling to develop a matrix for a biological model. Another objective is being able to work with several relevant computer software as tools for modeling wastewater treatment processes and running sensitivity analysis, calibration, and validation. At the end of this course, the students will be able to apply the theory concerning modeling practice in case studies with real datasets using one of the relevant software they learned. During the presentation, they will discuss and explain the outcome of the model.

Content

The course deals with the basis of wastewater modeling (kinetics, stoichiometry, mass balances, hydraulics, mixing, and matrix notation), an introduction of existing activated sludge models (ASM1, ASM2, ASM3, ASM2d), and a selection of computer programs (AQUASIM, SIMBA, GPS-X, and SUMO) in which the models can be built in and the protocol for the development of calibrated activated sludge models will be practiced. Different adjustments to basic ASM models for characterization of biofilm and granular sludge model, as well as anaerobic digestion models (ADM), will be also discussed. Besides the presentations, exercises form a part of the course. Finally, case studies with real datasets on modeling wastewater treatment plants will be practiced.

Module grade calculation

grade of the module is grade of the exam

Annotation

The number of participants in the course is limited to 20 persons. The registration is made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- preparation of report and presentation (examination): 60 h

total: 180 h

Recommendation

Vorkenntnisse in Siedlungswasserwirtschaft, Modul 'Urban Water Infrastructure and Management'

Literature

Chen, G.H., van Loosdrecht, M.C., Ekama, G.A. and Brdjanovic, D. eds., 2020. Biological wastewater treatment: principles, modeling and design. IWA publishing.

Makinia, J. and Zaborowska, E., 2020. Mathematical modelling and computer simulation of activated sludge systems. IWA publishing.

Mannina, G. ed., 2017. Frontiers in Wastewater Treatment and Modelling: FICWTM 2017 (Vol. 4). Springer.

M**6.99 Module: Modelling and Simulation of Electrochemical Systems [M-ETIT-100508]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)**Credits**
3**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

| Mandatory | | | |
|---------------|---|------|-------|
| T-ETIT-100781 | Modelling and Simulation of Electrochemical Systems | 3 CR | Weber |

Prerequisites

none

M**6.100 Module: Modern Concepts in Catalysis: From Science to Engineering [M-CIWVT-107149]**

Responsible: Prof. Dr. Jan-Dierk Grunwaldt
 Prof. Dr. Felix Studt
 Prof. Dr.-Ing. Gregor Wehinger

Organisation: KIT Department of Chemical and Process Engineering

Part of: **Technical Supplement Course** (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|----------------------------|
| T-CIWVT-114168 | Modern Concepts in Catalysis: From Science to Engineering | 4 CR | Grunwaldt, Studt, Wehinger |

M**6.101 Module: Module Master's Thesis [M-CIWVT-104526]**

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Master's Thesis](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------------|-------|---------|
| 30 | Grade to a tenth | Each term | 1 term | German/English | 5 | 4 |

| Mandatory | | | |
|----------------|---------------------------------|-------|-------|
| T-CIWVT-109275 | Master's Thesis | 30 CR | Rauch |

Prerequisites

Process Technology and at least three further modules of the advanced fundamentals has to be passed. The internship has to be passed. The examination board decides on exceptions.

(Compare SPO section 14 subsection 1)

Modeled Conditions

The following conditions have to be fulfilled:

- You have to fulfill 3 of 11 conditions:
 - The module M-CIWVT-103064 - Selected Formulation Technologies must have been passed.
 - The module [M-CIWVT-104384 - Biotechnological Production](#) must have been passed.
 - The module [M-CIWVT-103065 - Biopharmaceutical Purification Processes](#) must have been passed.
 - The module [M-CIWVT-103072 - Computational Fluid Dynamics](#) must have been passed.
 - The module M-CHEMBIO-104486 - Physical Chemistry (incl. Lab) must have been passed.
 - The module [M-CIWVT-103058 - Thermodynamics III](#) must have been passed.
 - The module [M-CIWVT-104383 - Kinetics and Catalysis](#) must have been passed.
 - The module [M-CIWVT-104378 - Particle Technology](#) must have been passed.
 - The module M-CIWVT-104377 - Thermal Transport Processes must have been passed.
 - The module [M-CIWVT-105380 - Membrane Technologies in Water Treatment](#) must have been passed.
 - The module [M-CIWVT-106297 - Bioprocess Development](#) must have been passed.
- The module [M-CIWVT-104374 - Process Technology](#) must have been passed.
- The module [M-CIWVT-104527 - Internship](#) must have been passed.

Workload

Homework: 900 h

M**6.102 Module: Molecular Biology and Genetics [M-CHEMBIO-106204]**

Responsible: Prof. Dr. Jörg Kämper
Prof. Dr. Natalia Requena Sanchez

Organisation: KIT Department of Chemistry and Biosciences

Part of: **Specialized Course I / New Bio-Production Systems - Electro-Biotechnology** (Usage from 10/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 5 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|------------------|---------------------------------------|------|-------------------------|
| T-CHEMBIO-103675 | Molecular Biology and Genetics | 5 CR | Kämper, Requena Sanchez |

Competence Certificate

Written exam of 120 minutes on the contents of the lecture parts Molecular Biology (3 LP) and Genetics (2 LP) (Total 5LP)

Prerequisites

none

Competence Goal

Students deepen their knowledge of the molecular basis of life and the technical possibilities of manipulating living organisms by altering their genes or their expression. This includes a deeper theoretical understanding of the following areas:

Microbiology, Genetics, Molecular Biology

Content**VL Genetics:**

DNA, DNA structure, DNA topology, chromosomes, chromatin, DNA replication, mutations, repair, transposable elements, assembly of genes, transcription, RNA processing, regulation of gene expression in pro- and eukaryotes (transcriptional, posttranscriptional, posttranslational), protein synthesis, epigenetics: Methylation, histone modifications, Human genetics, tumor genetics, genome projects, functional genomics/proteomics/bioinformatics, immunogenetics (introduction), developmental genetics (introduction), behavioral genetics (introduction).

VL Molecular Biology:

Molecular Biology Introduction, DNA extraction, restriction enzymes, cloning in vectors, library screening, bioinformatics, sequencing, genome sequencing, RNA, Northern blot, RT-PCR, Real time PCR, cDNA library, microarrays, recombinant proteins, western blot, affinity chromatography, mutagenesis, transformation.

Module grade calculation

The module grade is the grade of the written exam

Workload

Attendance time: 75 h

Follow-up and exam preparation: 75 h

Total: 150 h

5 LP

Learning type

Lectures

Literature**VL Genetics:**

Content of the lecture in keywords

Textbooks of genetics, e.g. Knippers, Molecular Genetics, 9th edition; Watson, Molecular Biology of the Gene, 5th edition; Griffiths, Introduction to Genetic Analysis, 9th edition.

VL Molecular Biology:

Textbooks of molecular biology, e.g., Molecular Cell Biology-Lodish (Spektrum), Watson Molecular Biology (Pearson).

M**6.103 Module: Nanoparticles – Structure and Function [M-CIWVT-104339]**

Responsible: Dr.-Ing. Jörg Meyer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Gas Particle Systems](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-108894 | Nanoparticles – Structure and Function | 6 CR | Meyer |

Competence Certificate

The examination is an oral examination with a duration of about 30 minutes in case of a single module examination and 20 minutes in case of a overall examination of the specialized course (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students develop an understanding of the correlation between structure of nanoscaled systems and their physical properties. Additionally, they understand how process parameters in the synthesis of nanoscaled particle systems determine the resulting particle structure.

Based on the knowledge of the structure-function-relationships and of the synthesis routes, the students can develop strategies for the systematic generation and optimization of nanoparticulate systems for specific applications.

Content

- Technical and historical classification of the lecture content
- Methods for visualization of nanoscaled objects and structures
- Description and physical basis of specific properties of nanoscaled particles (and other structures / shapes)
 - Size dependency of surface energy
 - Modification of the phase transition temperature (compared to the bulk phase)
 - Mechanical properties
 - Optical properties
 - electrical properties
- Methods for synthesizing nanoscaled particle systems in the gas phase with well-defined properties
- Relevant process parameters for the adjustment of
 - Particle size (primary particle and agglomerate size)
 - Agglomeration state
 - Agglomerate strength
 - Structure / phase of the particle material
 - Chemical structure of particle surface
 - Multi-level structuring (core-shell, nanoparticles on support structures)

Module grade calculation

The module grade ist the grade of oral examination.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

M**6.104 Module: NMR for Engineers [M-CIWVT-104401]**

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Water Technology](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-----------|
| T-CIWVT-108984 | NMR for Engineers | 4 CR | Guthausen |
| T-CIWVT-109144 | Laboratory Work for NMR for Engineers | 2 CR | Guthausen |

Prerequisites

None

Competence Goal

Knowledge about NMR and their applications, basic understanding of the phenomena

Content

An overview of applications of nuclear magnetic resonance (NMR) will be given together with the basic description of this analytical tool. In the focus of the lectures are typical applications of NMR in chemical and bio engineering. The understanding of this versatile analytical method will be developed on the basis of dedicated examples.

Workload

- Attendance time (Lecture): 30 h
- Revision course: 30 h
- Internship: Attendance Time 30 h, Preparation Time 30 h
- Exam Preparation: 60 h

Literature

Lehrbücher Kimmich und Callaghan, weitere Literatur wird jeweils in der Vorlesung angegeben.

M**6.105 Module: NMR Methods for Product and Process Analysis [M-CIWVT-105890]****Responsible:** apl. Prof. Dr. Gisela Guthausen**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 4/1/2022)
[Specialized Course I / Water Technology](#) (Usage from 4/1/2022)
[Specialized Course I / Biopharmaceutical Process Engineering](#) (Usage from 4/1/2022)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-----------|
| T-CIWVT-111843 | NMR Methods for Product and Process Analysis | 4 CR | Guthausen |

Prerequisites

None

Competence Goal

Knowledge about NMR and their applications, basic understanding of the phenomena.

Content

An overview of applications of nuclear magnetic resonance (NMR) will be given together with the basic description of this analytical tool. In the focus of the lectures are typical applications of NMR in chemical and bio engineering. The understanding of this versatile analytical method will be developed on the basis of dedicated examples.

Module grade calculation

The module grade ist the grade of the oral examination.

Workload

- Attendance time (Lecture): 30 h
- Revision course: 30 h
- Exam Preparation: 60 h

Literature

Lehrbücher Kimmich und Callaghan, weitere Literatur wird jeweils in der Vorlesung angegeben.

M**6.106 Module: Nonlinear Process Control [M-CIWVT-106316]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-112824 | Nonlinear Process Control | 6 CR | Meurer |

Competence Certificate

Learning control is an oral examination with a duration of about 45 minutes.

Prerequisites

None

Content

Nonlinearities are ubiquitous in nature. Differing from linear control theory and linear control systems, which typically rely on the local linearization of a nonlinear system around some equilibrium, this module addresses nonlinear concepts for the analysis and the control of nonlinear systems. The course covers the following topics:

- Introduction to the dynamic analysis of nonlinear systems
- Differential geometric concepts
- Exact feedback linearization
- Differential flatness and flatness-based feedforward and tracking control
- Lyapunov theory and Lyapunov-based design methods

Problem sets are considered in the exercises to apply the developed methods using analytical tools as well as computer algebra systems to realize the design approaches.

Module grade calculation

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

Annotation

If required, the course will be offered in English.

Workload

Attendance time: Lectures: 30 hrs. Exercises: 15 hrs.

Self-study: 75 hrs.

Exam preparation: 60 hrs.

Literature

- T. Meurer: Nonlinear Process Control, Lecture Notes.
- B. Brogliato, R. Lozano, B. Maschke, O. Egeland: Dissipative systems analysis and control, Springer, 2007.
- H. Nijmeijer, A.J. van der Schaft: Nonlinear Dynamical Control Systems. Springer, 1991.
- Isidori: Nonlinear Control Systems. Springer-Verlag, 1995.
- H. K. Khalil: Nonlinear Systems, Prentice Hall, 2002.
- M. Krstic, I. Kanellakopoulos, P. Kokotovic: Nonlinear and Adaptive Control Design, John Wiley & Sons, 1995.
- S. Sastry: Nonlinear Systems, Analysis, Stability, Control. Springer-Verlag, 1999.
- A. J. van der Schaft: L2-gain and passivity techniques in nonlinear control, Springer, 2016.
- M. Vidyasagar: Nonlinear Systems Analysis, SIAM, 2002.



6.107 Module: Numerical Methods in Fluid Mechanics [M-MATH-102932]

Responsible: Prof. Dr. Willy Dörfler
PD Dr. Gudrun Thäter

Organisation: KIT Department of Mathematics

Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|---------------|--|------|-----------------|
| T-MATH-105902 | Numerical Methods in Fluid Mechanics | 4 CR | Dörfler, Thäter |

Competence Certificate

Oral exam of about 20 minutes.

Prerequisites

None

Competence Goal

Participants know about the modelling and physical basics that lead to the model equations. They know how to discretize fluidmechanical problems with the finite element method and know especially how to treat the incompressibility condition. They are able to analyze stability and convergence of the presented methods.

Content

- Modelling and derivation of the Navier-Stokes equations
- Mathematical and physical representation of energy and stress
- Lax-Milgram theorem, Céa lemma and saddle point theory
- Analytical and numerical treatment of the potential and Stokes flow
- Stability and convergence of the discrete models
- Numerical treatment of the stationary nonlinear equation
- Numerical treatment of the instationary problems
- Applications

Module grade calculation

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

Workload

Total workload: 120 hours

Attendance: 45 h

- lectures, problem classes and examination.

Self studies: 75 h

- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination.

Recommendation

Basic knowledge in the numerical treatment of differential equations, such as boundary value problems or initial value problems is strongly recommended. Knowledge in functional analysis is recommended.

M**6.108 Module: Numerical Simulation of Reacting Multiphase Flows [M-CIWVT-106565]**

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Specialized Course I / Mechanical Process Engineering](#) (Usage between 4/1/2025 and 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 8 | Grade to a tenth | Each summer term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-113232 | Numerical Simulation of Reacting Multiphase Flows - Prerequisite | 6 CR | Stein |
| T-CIWVT-113233 | Numerical Simulation of Reacting Multiphase Flows | 2 CR | Stein |

Competence Certificate

The learning control consists of two partial achievements:

1. Completed Coursework: As a prerequisite for the oral exam, reports on the tutorial have to be submitted. These document the processed task, the generated data and their analysis.
2. Oral examination lasting approx. 30 minutes.

Prerequisites

The completed coursework is a prerequisite for participation in the oral examination.

Competence Goal

Course participants can explain basic and advanced concepts related to the modelling and simulation of reacting multiphase flows. They are knowledgeable of the governing equations of both single and multiphase flows and can describe the physical meaning of all terms in these equations. They can explain the fundamentals of turbulence and turbulence modelling, chemical conversion and multiphase flow modelling. They are knowledgeable of numerical approximation and solution methods for reacting multiphase flows and know how to apply them. In the related tutorials with the OpenFOAM software, they have obtained a first practical experience in setting up, running and analysing their simulations and are capable of applying the obtained knowledge to further simulation tasks.

Content

- Basics of computational fluid dynamics
- Governing equations, turbulence & turbulence modelling
- Chemical conversion and reacting flows
- Non-reacting and reacting multiphase flows
- Numerical approximation and solution methods

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

The OpenFOAM tutorials will be conducted on the students' laptops. All course material is provided in English, while the lecture will be held in German or English, as required.

Workload

- Attendance time
Lectures 2 SWS: 30 h
Tutorials 2 SWS: 30 h
- Self-study
Preparation and wrap-up lectures: 15 h
Data analysis, preparation and submission of reports: 105 h
- Exam preparation:
60h

Literature

Will be announced.

M**6.109 Module: Numerical Simulation of Reacting Multiphase Flows [M-CIWVT-107076]**

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2025)
[Specialized Course I / Fuel Technology](#) (Usage from 4/1/2025)
[Specialized Course I / Energy Process Engineering](#) (Usage from 4/1/2025)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2025)
[Specialized Course I / Combustion Technology](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 8 | Grade to a tenth | Each summer term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-114117 | Numerical Simulation of Reacting Multiphase Flows - Prerequisite | 5 CR | Stein |
| T-CIWVT-114118 | Numerical Simulation of Reacting Multiphase Flows | 3 CR | Stein |

Competence Certificate

The learning control consists of two partial achievements:

1. Completed Coursework: As a prerequisite for the oral exam, reports on the tutorial have to be submitted. These document the processed task, the generated data and their analysis.
2. Oral examination lasting approx. 30 minutes.

Prerequisites

The completed coursework is a prerequisite for participation in the oral examination.

Competence Goal

Course participants can explain basic and advanced concepts related to the modelling and simulation of reacting multiphase flows. They are knowledgeable of the governing equations of both single and multiphase flows and can describe the physical meaning of all terms in these equations. They can explain the fundamentals of turbulence and turbulence modelling, chemical conversion and multiphase flow modelling. They are knowledgeable of numerical approximation and solution methods for reacting multiphase flows and know how to apply them. In the related tutorials with the OpenFOAM software, they have obtained a first practical experience in setting up, running and analysing their simulations and are capable of applying the obtained knowledge to further simulation tasks.

Content

- Basics of computational fluid dynamics
- Governing equations, turbulence & turbulence modelling
- Chemical conversion and reacting flows
- Non-reacting and reacting multiphase flows
- Numerical approximation and solution methods

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

The OpenFOAM tutorials will be conducted on the students' laptops. All course material is provided in English, while the lecture will be held in German or English, as required.

Workload

- Attendance time
Lectures 2 SWS: 30 h
Tutorials 2 SWS: 30 h
- Self-study
Preparation and wrap-up lectures: 15 h
Data analysis, preparation and submission of reports: 105 h
- Exam preparation:
60 h

Literature

Will be announced.

M**6.110 Module: Optimal and Model Predictive Control [M-CIWVT-106317]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-112825 | Optimal and Model Predictive Control | 6 CR | Meurer |

Competence Certificate

Learning control is an oral examination with a duration of about 45 minutes.

Prerequisites

none

Competence Goal

Informationen folgen

Content

Many problems in industry and economy rely on the determination of an optimal solution satisfying desired performance criteria and constraints. In mathematical terms this leads to the formulation of an optimization problem. Here it is in general distinguished between static and dynamic optimization with the latter involving a dynamical process. This lecture gives an introduction to the mathematical analysis and numerical solution of dynamic optimization problems with a particular focus on optimal control and model predictive control. The lecture addresses the following topics:

- Fundamentals of dynamic optimization problems
- Dynamic optimization without and with constraints
- Linear and nonlinear model predictive control
- Numerical methods

Selected examples are considered and solved in the exercises and dedicated computer exercises.

Module grade calculation

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

Workload

Attendance time: Lectures: 30 hrs. Exercises: 15 hrs.

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

- T. Meurer: Optimal and Model Predictive Control, Lecture Notes.
- D. G. Luenberger, Y. Ye: Linear and Nonlinear Programming, Springer, 2008.
- J. Nocedal, S.J. Wright: Numerical Optimization, Springer, 2006.
- M. Papageorgiou, M. Leibold, M. Buss: Optimierung, Springer, 2012.
- E. Camacho, C. Alba: Model Predictive Control, Springer, 2004
- L. Grüne, J. Pannek: Nonlinear Model Predictive Control: Theory and Algorithms, Springer, 2011.
- L. Wang: Model Predictive Control System Design and Implementation Using MATLAB, Springer, 2009.

M**6.111 Module: Organ Support Systems [M-MACH-102702]****Responsible:** apl. Prof. Dr. Christian Pylatiuk**Organisation:** KIT Department of Mechanical Engineering**Part of:** Technical Supplement Course
Specialized Course I / Biopharmaceutical Process Engineering

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 2 |

| Mandatory | | | |
|---------------|-----------------------|------|----------|
| T-MACH-105228 | Organ Support Systems | 4 CR | Pylatiuk |

Competence Certificate

A performance assessment is held in form of a written examination of 60 minutes.

Prerequisites

none

Competence Goal

Students have comprehensive knowledge of the functioning of support systems and their components (e.g. sensors, actuators) for different human organs (e.g. heart, kidney, liver, eye, ear, locomotor system). They know the physical basics, the technical solutions and the essential aspects of these medical technology systems and their current limitations. Furthermore, they know bioreactors and other methods of using the body's own cells to support organs (tissue engineering). Furthermore, they have comprehensive knowledge of organ transplantation and its limitations.

Content

Hemodialysis, liver dialysis, heart-lung machine, artificial hearts, biomaterials, definition and classification of organ support and organ replacement, hearing prostheses, visual prostheses, exoskeletons, neuroprostheses, endoprostheses, tissue engineering.

Module grade calculation

The module grade is the grade of the written exam.

Workload

1. Attendance time Lecture: $15 \cdot 2\text{h} = 30\text{h}$
2. Pre- and postprocessing time Lecture: $15 \cdot 3\text{h} = 45\text{h}$
3. Exam preparation and attendance exam: 45h

Total: 120h = 4 LP

Recommendation

The content of module MMACH-105235 complements this lecture.

Literature

- Jürgen Werner: Kooperative und autonome Systeme der Medizintechnik: Funktionswiederherstellung und Organersatz. Oldenbourg Verlag.
- Rüdiger Kramme: Medizintechnik: Verfahren - Systeme – Informationsverarbeitung. Springer Verlag.
- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

M**6.112 Module: Parallel Computing [M-MATH-101338]**

Responsible: PD Dr. Mathias Krause
Prof. Dr. Christian Wieners

Organisation: KIT Department of Mathematics

Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 10/1/2024)

Credits
5

Grading scale
Grade to a tenth

Recurrence
Irregular

Duration
1 term

Level
5

Version
1

| Mandatory | | | |
|---------------|------------------------------------|------|-----------------|
| T-MATH-102271 | Parallel Computing | 5 CR | Krause, Wieners |

Prerequisites

None

M**6.113 Module: Particle Technology [M-CIWVT-104378]**

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(CIW\)](#)
[Technical Supplement Course](#)

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-106028 | Particle Technology Exam | 6 CR | Dittler |

Competence Certificate

Learning control is a written examination lasting 120 minutes.

Prerequisites

None

Competence Goal

Students develop an advanced understanding of properties & behavior of particles and particulate systems in important engineering applications; they are able to use this understanding for calculations and design of selected processes

Content

Description and behavior of particles and particulate systems in engineering applications; selected unit operations in particle technology.

Module grade calculation

The module grade ist the grade of the written exam.

Workload

- Attendance time (Lecture): 45 h
- Homework: 90 h
- Exam Preparation: 45 h

M**6.114 Module: Physical Foundations of Cryogenics [M-CIWVT-103068]**

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-106103 | Physical Foundations of Cryogenics | 6 CR | Grohmann |

Competence Certificate

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

Prerequisites

None

Competence Goal

Understanding of the mechanisms of entropy generation, and the interaction of the first and the second law in thermodynamic cycles; understanding of cryogenic material properties; application, analysis and assessment of real gas models for classical helium I; understanding of quantum fluid properties of helium II based on Bose-Einstein condensation, understanding of cooling principles at lowest temperatures.

Content

Relation between energy and temperature, energy transformation on microscopic and on macroscopic scales, physical definitions of entropy and temperature, thermodynamic equilibria, reversibility of thermodynamic cycles, helium as classical and as quantum fluid, low-temperature material properties, cooling methods at temperatures below 1 K.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 45 h
- Exam Preparation: 90 h

Literature

Schroeder, D.V.: An introduction to thermal physics. Addison Wesley Longman (2000)
 Pobell, F.: Matter and methods at low temperatures. 3rd edition, Springer (2007)

M**6.115 Module: Polymer Thermodynamics [M-CIWVT-106882]**

Responsible: Prof. Dr. Sabine Enders
Prof. Dr.-Ing. Tim Zeiner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2024)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German/English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|----------------|
| T-CIWVT-113796 | Polymer Thermodynamics | 6 CR | Enders, Zeiner |

Competence Certificate

Learning contrl is an oral exam, duration approx. 30 minutes.

Prerequisites

None

Competence Goal

Students are able to understand complex phase equilibria and they are able to calculate these complex phase equilibria and know the required thermodynamic models and the corresponding parameter fitting procedure.

Content

- Phase equilibria of multi-component mixtures (e.g. polymers, electrolyte solution)
- numerical methods for calculation of complex phase equilibria
- thermodynamic models
- estimation of model parameters

Module grade calculation

The grade of the module ist the grade of the oral exam.

Annotation

If required, the course will be offered in English.

Workload

- Lectures and Exercises: 90 hrs.
- Self-study: 45 hrs.
- Exam preparation: 45 hrs.

Literature

Chemical Thermodynamics for Process Simulation, J. Gmehling, B. Kolbe, M. Kleiber, J. Raray (Eds.), Wiley-VCH, 2012. ISBN: 978-3-527-31277-1.

M**6.116 Module: Power-to-X – Key Technology for the Energy Transition [M-CIWVT-105891]**

Responsible: Prof. Dr.-Ing. Roland Dittmeyer
Dr. Peter Holtappels

Organisation: KIT Department of Chemical and Process Engineering

Part of: **Technical Supplement Course** (Usage from 4/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|-----------------------|
| T-CIWVT-111841 | Power-to-X – Key Technology for the Energy Transition | 4 CR | Dittmeyer, Holtappels |
| T-CIWVT-111842 | Practical in Power-to-X: Key Technology for the Energy Transition | 2 CR | Dittmeyer, Holtappels |

Competence Certificate

The learning control consists of two partial achievements:

1. Lab, completed coursework
2. Oral examination lastin approx. 30 minutes

Competence Goal

The students are familiar with the rationale and the basic concepts of Power-to-X conversion. They know the major routes and individual components and what can be expected in terms of performance metrics both on component and process level. They have developed a basic understanding of water and steam electrolysis as well as of plasma splitting of carbon dioxide. Moreover, they had a first encounter with real container plants for electrolysis and fuel synthesis in the Energy Lab 2.0 as well as modular setups for plasma splitting, fuel synthesis and fuel upgrading.

Content

The module will provide an introduction to Power-to-X technologies which are expected to play a major role in the future energy system. The rationale for converting renewable electrical energy into fuels and chemicals will be explained and substantiated with data from relevant studies. Concepts for central and distributed Power-to-X facilities will be described with a focus on modular technologies for distributed production. Different options for water and steam electrolysis as well as selective electrochemical reduction of carbon dioxide will be discussed with a view to technology readiness level, energy efficiency, and cost. The alternative concept of plasma-based activation of inert molecules will be introduced and the status of this technology will be assessed and compared to electrolysis. Basic process layouts for production of synthetic methane, liquid hydrocarbons, methanol and ammonia from renewable electrical energy, carbon dioxide and water will be described and assessed in terms of material and energy flows and options for process integration. Moreover, concepts for offshore Power-to-X production will be explained and current research in this area will be highlighted. Finally, industrial project initiatives in the field of Power-to-X will be presented and discussed. The practical will cover four days and will be done in larger groups of up to 15 persons. Participants will be introduced to the containerized Power-to-Liquid Plant and its infrastructure in the Energy Lab 2.0 at KIT Campus North. They will work at this site with a containerized water electrolyzer and steam electrolyzer for hydrogen production. Moreover, the group will be made familiar with an experimental setup for plasma splitting of carbon dioxide in the plasma lab jointly operated by IMVT and IHM and with the synthesis and upgrading of Fischer-Tropsch-Fuels in the synfuel lab at IMVT.

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

Practical course: Dates by arrangement, Location: IMVT, KIT Campus Nord, Energy Lab 2.0, Building 605.

Workload

- Attendance time:
lecture: 30 h,
lab: 16 h (4 dates)
- Self-study: 90 h
- Exam preparation: 45 h

Literature

Florian Ausfelder, Hannah Dura, 3. Roadmap des Kopernikus-Projektes P2X Phase II, OPTIONEN FÜR EIN NACHHALTIGES ENERGIE- SYSTEM MIT POWER-TO-X- TECHNOLOGIEN, Transformation – Anwendungen – Potenziale, 2021 (https://www.kopernikus-projekte.de/aktuelles/news/p2x_roadmap_3_0)

M**6.117 Module: Practical Course Combustion Technology [M-CIWVT-104321]**

Responsible: Dr.-Ing. Stefan Raphael Harth
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Combustion Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German/English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-108873 | Practical Course Combustion Technology | 4 CR | Harth |

Competence Certificate

The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO) about experiments.

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are able to analyze results of combustion experiments and to assess the measurements methods.

Content

The laminar flame speed is experimentally determined, stability limits of combustion systems are investigated and the process of combustion is analyzed. Different measurement techniques (e.g. exhaust gas probes or optical measurement techniques) are applied.

Annotation

Dates of experiments by arrangement. Please contact the responsible person (stefan.harth@kit.edu) for registration by May the 15th by the latest.

If necessary, the course will be held in English.

Workload

- Experiments: 30 h (3 - 4 experiments depending on the complexity of the used test stands)
- Homework, test records: 50 h
- Exam preparation: 40 h

M**6.118 Module: Practical Course in Water Technology [M-CIWWT-103440]**

Responsible: Dr. Andrea Hille-Reichel
Prof. Dr. Harald Horn

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Water Technology](#) (Usage from 10/1/2019)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 3 |

| Mandatory | | | |
|----------------|--|------|---------------------|
| T-CIWWT-106840 | Practical Course in Water Technology | 3 CR | Hille-Reichel, Horn |
| T-CIWWT-110866 | Excursions: Water Supply | 1 CR | Horn |

Competence Certificate

The learning control consists of:

- Laboratory: 6 Experiments including entrance test, protocol; presentation about a selected experiment (about 15 minutes); final test (SPO section 4, subsection 2 No. 3)
- Excursions, protocols about excursions (ungraded)

Prerequisites

Module 'Water Technology (PA221)'

Modeled Conditions

The following conditions have to be fulfilled:

1. The module [M-CIWWT-103407 - Water Technology](#) must have been started.

Competence Goal

Students can explain the most important processes in water treatment. They are able to do calculations, and to compare and interpret data. They learn how to use different methods, and to interpret different processes.

Content

6 different experiments out of: equilibrium study of the calcium carbonate system, flocculation, adsorption, oxidation, atomic absorption spectroscopy, ion chromatography, liquid chromatography, sum parameter, and an oral presentation of the student. In addition, excursions to two different treatment plants (waste water, drinking water).

Module grade calculation

Module grade is the grade of the laboratory and is formed as follows:

A total of 150 points can be achieved:

- maximum 60 points for the experiments (10 each)
- maximum 15 points for the presentation
- maximum 75 points for the final certificate

At least 80 points must be achieved in order to pass.

Workload

Attendance time: Introduction and presentation (4 h), 6 Experiments (4 h each), 2 excursions: 36 h

Preparation/follow-up, protocols, presentation: 50 h

Examination + exam preparation: 34 h

Literature

- Harris, D. C., Lucy, C. A. (2019): . Quantitative chemical analysis, 10. edition. W. H. Freeman and Company, New York.
- Crittenden, J. C. et al. (2012): Water treatment – Principles and design. Wiley & Sons, Hoboken.
- Patnaik, P., 2017: Handbook of environmental analysis: Chemical pollutants in air, water, soil, and solid wastes. CRC Press.
- Wilderer, P. (Ed., 2011): Treatise on water science, four-volume set, 1st edition, volume 3: Aquatic chemistry and biology. Elsevier, Oxford.
- Vorlesungsskript im ILIAS
- Praktikumsskript

M**6.119 Module: Principles of Ceramic and Powder Metallurgy Processing [M-CIWVT-104886]**

Responsible: apl. Prof. Dr. Günter Schell
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|---------------|--|------|--------|
| T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | 4 CR | Schell |

Competence Certificate

Learning control is an oral examination with a duration of about 25 minutes, SPO section 4 subsection 2.

Prerequisites

None

Competence Goal

The students know the basics of characterization of powders, pastes and suspensions. They have a fundamental understanding of the process technology for shaping of particulate systems. They are able to use these fundamentals to design selected wet- and dry forming processes.

Content

The course covers fundamentals of the process technology for shaping of ceramic or metal particle systems. Important shaping methods are reviewed. The focus is on characterization and properties of particulate systems, and, in particular, on process technology for shaping of powders, pastes, and suspensions.

Module grade calculation

Module grade is the grade of oral examination.

Workload

- Attendance Time: 30 h
- Homework: 45 h
- Exam preparation: 45 h

Recommendation

Knowledge of general material science is required.

Literature

- Folien zur Vorlesung: verfügbar unter <http://ilias.studium.kit.edu>
- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Ceramic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- Schatt ; K.-P. Wieters ; B. Kieback. „Pulvermetallurgie: Technologien und Werkstoffe“, Springer, 2007
- R.M. German. “Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- Thümmeler, R. Oberacker. “Introduction to Powder Metallurgy”, Institute of Materials, 1993

M**6.120 Module: Principles of Constrained Static Optimization [M-CIWVT-106313]**

Responsible: Dr.-Ing. Pascal Jerono
Prof. Dr.-Ing. Thomas Meurer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|----------------|
| T-CIWVT-112811 | Principles of Constrained Static Optimization | 4 CR | Jerono, Meurer |

Competence Certificate

Learning control is an oral exam with a duration of about 45 minutes.

Prerequisites

None

Content

Optimization problems arise in a broad variety in different scientific and engineering domains ranging from the fit of parameter based on a performance criterion to finding extreme values of an objective function and further extending to machine learning applications. While dynamic optimization (addressed on the module M-CIWVT-106317) involves dynamical systems in static optimization the minimization (maximization) of functions subject to equality and inequality constraints is considered. This module gives an introduction to the mathematical analysis and numerical solution of unconstrained and constrained static optimization problems. The lecture addresses the following topics:

- Fundamentals of static optimization problems
- Unconstrained static optimization
- Constrained static optimization
- Numerical methods

Selected examples are considered and solved in the exercises and dedicated computer exercises.

Module grade calculation

The grade of the module ist the grade of the oral exam.

Workload

Attendance time: Lectures: 15 hrs. exercises: 15 hrs.

Self-study: 50 hrs.

Exam preparation: 40 hrs.

M**6.121 Module: Principles of Medicine for Engineers [M-MACH-102720]****Responsible:** apl. Prof. Dr. Christian Pylatiuk**Organisation:** KIT Department of Mechanical Engineering**Part of:** Technical Supplement Course
Specialized Course I / Biopharmaceutical Process Engineering

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|---------------|--------------------------------------|------|----------|
| T-MACH-105235 | Principles of Medicine for Engineers | 4 CR | Pylatiuk |

Competence Certificate

A performance assessment is held in form of a written examination of 45 minutes.

Prerequisites

none

Competence Goal

Students have a comprehensive understanding of the functioning and anatomical construction of organs, which are assigned to different medical disciplines. Furthermore, they know the physical basics, the technical solutions and the essential aspects of the application of medical technology procedures in diagnostics and therapy. They are familiar with common clinical pictures in the different medical disciplines and their relevance in health care. Through their acquired knowledge, students can communicate with physicians about medical-technical procedures and assess mutual expectations more realistically.

Content

Definition of disease and health and history of medicine, evidence-based medicine" and personalized medicine, nervous system, conduction, musculoskeletal system, cardiovascular system, anesthesia, respiratory system, sensory organs, gynecology, digestive organs, surgery, nephrology, orthopedics, immune system, genetics.

Module grade calculation

The module grade is the grade of the written exam.

Workload

1. Attendance time Lecture: $15 * 2h = 30h$
2. Pre- and postprocessing time Lecture: $15 * 3h = 45h$
3. Exam preparation and attendance exam: 45h

Total: 120h = 4 LP

Recommendation

The content of module MMACH-105228 complements this lecture.

Literature

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

M**6.122 Module: Process Analysis: Modeling, Data Mining, Machine Learning [M-ETIT-105594]**

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: [Technical Supplement Course](#) (Usage from 10/1/2022)
[Specialized Course I / Automation and Process Systems Engineering](#)

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
2

| Mandatory | | | |
|---------------|---|------|--------------------|
| T-ETIT-111214 | Process Analysis: Modeling, Data Mining, Machine Learning | 4 CR | Borchert, Heizmann |

Prerequisites

none

Module grade calculation

Die Modulnote ist die Note der mündlichen Prüfung.

M**6.123 Module: Process and Plant Safety [M-CIWVT-104352]**

Responsible: Hon.-Prof. Dr. Jürgen Schmidt
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Environmental Process Engineering](#)
[Specialized Course I / Thermal Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-108912 | Process and Plant Safety | 4 CR | Schmidt |

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are able to systematically assess the risks of technical systems, assess the effects of possible accidents and define suitable safety measures. The lecture is divided into thematic blocks. Lecture block 01 is an introduction to the topic:

Lecture blocks

1. Introduction
2. risk management
3. hazardous substances
4. Exothermic Chemical Reactions
5. safety devices
6. effluent systems
7. Dispersion of hazardous substances
8. PLT protective devices
9. explosion protection
10. electrostatics

Content

Introduction to safeguarding processes and plants to protect people and the environment from potential hazards of technical plants in the chemical, petrochemical, pharmaceutical and oil and gas sectors. Risk management can be used to prevent incidents and limit the impact of events. This includes topics such as technical safety of plants, risk management, prevention of hazards from substances and dangerous chemical reactions, design of protective devices for emergency relief such as safety valves, bursting discs and downstream containment devices. Modern process control systems, emission and dispersion of hazardous substances in the atmosphere, and explosion and fire protection.

Workload

- Attendance time (Lecture): 30 h
- Homework: 30 h
- Exam Preparation: 60 h

M**6.124 Module: Process Development in the Chemical Industry [M-CIWVT-104389]**

Responsible: Hon.-Prof. Dr. Jürgen Dahlhaus
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Additional Examinations](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 2 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-108961 | Process Development in the Chemical Industry | 2 CR | Dahlhaus |

Prerequisites

None

M**6.125 Module: Process Engineering for the Production of Food from Animal Origins [M-CIWVT-106699]****Responsible:** PD Dr. Volker Gaukel**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2024)[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-113477 | Process Engineering for the Production of Food from Animal Origins | 4 CR | Gaukel |

Competence Certificate

Learning control is an oral examination with a duration about of 30 minutes.

Prerequisites

None

Competence Goal

Students understand and are able to explain conventional methods for producing foods, even complex ones, from animals. They know unit operations of relevance, both conventional and innovative approaches. They are able to design the processes according to raw material specifics. They identify correlations between process parameters and quality-determining properties of food. They are also able to transfer process knowledge between individual product groups. They know essential aspects required to assess sustainability and energy aspects of the individual process steps and complete process chains.

Students are able to apply principles of product design. This involves identifying the relationships between process parameters and the structure of a food product (process function) as well as between the inner structure of foods and their properties (property function). Based on this, they are able to analyze and solve problems in the field of food process engineering.

Students are able to use their knowledge to evaluate a process unit with regard to food production, involving aspects such as sustainability, energy efficiency, food safety and expected product quality.

Module grade calculation

Grade of the module is the grade of oral examination.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

Literature

- Vorlesungsfolien & Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)
- H.P. Schuchmann und H. Schuchmann: Lebensmittelverfahrenstechnik: Rohstoffe, Prozesse, Produkte; Wiley VCH, 2005; ISBN: 978-3-527-66054-4 (auch als ebook)
- H.G. Kessler: Lebensmittel- und Bioverfahrenstechnik – Molkereitechnologie, Verlag A. Kessler, 1996, ISBN 3-9802378-4-2
- H.G. Kessler: Food and Bio Process Engineering - Dairy Technology, Publishing House A. Kessler, 2002, ISBN 3-9802378-5-0
- M. Loncin: Die Grundlagen der Verfahrenstechnik in der Lebensmittelindustrie; Aarau Verlag, 1969, ISBN 978-3794107209

M**6.126 Module: Process Engineering for the Production of Food from Plant-Based Raw Materials [M-CIWVT-106698]**

Responsible: Dr.-Ing. Ulrike van der Schaaf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2024)
[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------------|
| T-CIWVT-113476 | Process Engineering for the Production of Food from Plant-Based Raw Materials | 4 CR | van der Schaaf |

Competence Certificate

The examination is an oral examination with a duration of about 30 minutes.

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students understand and are able to explain conventional methods for producing foods, even complex ones, from plants. They know process chains and unit operations of relevance, both conventional and innovative approaches. They are able to design the processes according to raw material specifics. They identify correlations between process parameters and quality-determining properties of food. They are also able to transfer process knowledge between individual product groups. They know essential aspects required to assess sustainability and energy aspects of the individual process steps and complete process chains.

Students are able to apply principles of product design. This involves identifying the relationships between process parameters and the structure of a food product (process function) as well as between the inner structure of foods and their properties (property function). Based on this, they are able to analyze and solve problems in the field of food process engineering.

Students are able to use their knowledge to evaluate a process unit with regard to food production, involving aspects such as sustainability, energy efficiency, food safety and expected product quality.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

Literature

- H.P. Schuchmann und H. Schuchmann: Lebensmittelverfahrenstechnik: Rohstoffe, Prozesse, Produkte; Wiley VCH, 2005; ISBN: 978-3-527-66054-4 (auch als ebook)
- H.G. Kessler: Lebensmittel- und Bioverfahrenstechnik – Molkereitechnologie, Verlag A. Kessler, 1996, ISBN 3-9802378-4-2
- H.G. Kessler: Food and Bio Process Engineering - Dairy Technology, Publishing House A. Kessler, 2002, ISBN 3-9802378-5-0
- M. Loncin: Die Grundlagen der Verfahrenstechnik in der Lebensmittelindustrie; Aarau Verlag, 1969, ISBN 978-3794107209
- Vorlesungsfolien & Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)

M**6.127 Module: Process Engineering in Wastewater Treatment [M-BGU-103399]****Responsible:** Dr.-Ing. Tobias Morck**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences**Part of:** [Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|--------------|---|------|-------|
| T-BGU-106787 | Process Engineering in Wastewater Treatment | 6 CR | Morck |

Competence Certificate

- 'Teilleistung' T-BGU-106787 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

Students acquire knowledge about typical techniques in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs. Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content

Municipal Wastewater Treatment: Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany. Following processes are covered:

- different activated sludge processes
- anaerobic technologies and energy-recovery systems
- filtration technologies
- wastewater disinfection and pathogen removal
- chemical and biological phosphorus removal
- micro-pollutants removal
- resource management and energy efficiency

International Sanitary Engineering: Students get acquainted with the design and operation used for wastewater treatment at international level. They analyze, evaluate and take decisions when new and more holistic oriented methods can be implemented. Following topics are covered:

- activated sludge processes
- trickling filters and rotating biological contactors
- treatment ponds
- retention soil filter / Wetlands
- UASB/EGSB/Anaerobic filter
- decentralized versus centralized systems
- material flow separation
- energy-recovery from wastewater
- drinking water purification
- waste management

Module grade calculation

grade of the module is grade of the exam

Annotation**IMPORTANT:**

The module will not be offered anymore as from summer term 2019. It will be replaced by the module Wastewater Treatment Technologies.

group presentation and written report is internal examination prerequisite.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Municipal Wastewater Treatment lecture/exercise: 30 h
- International Sanitary Engineering lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Municipal Wastewater Treatment: 30 h
- preparation and follow-up lecture/exercises International Sanitary Engineering: 30 h
- examination preparation: 60 h

total: 180 h

Recommendation

module 'Urban Water Infrastructure and Management'

Literature

Imhoff, K. u. K.R. (1999) Taschenbuch der Stadtentwässerung, 29. Aufl., Oldenbourg Verlag, München, Wien
ATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, Berlin
ATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn, Berlin
Sperling, M.; Charnicaro, C.A.L. (2005) Biological wastewater treatment in warm climate regions, IWA publishing, London
Wilderer, P.A., Schroeder, E.D. and Kopp, H. (2004) Global Sustainability - The Impact of Local Cultures. A New Perspective for Science and Engineering, Economics and Politics WILEY-VCH

M**6.128 Module: Process Instruments and Machinery and Their Process Integration [M-CIWVT-104351]**

Responsible: Dr.-Ing. Manfred Nagel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-108910 | Process Instruments and Machinery and Their Process Integration | 4 CR | Nagel |

Competence Certificate

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

Prerequisites

None

Competence Goal

Skills to develop holistic processes for product design. Knowledge about task of engineers in process industry.

Content

Teaching of methods and creating awareness about boundary conditions related to scientific and systematic engineering approaches in process development. In Bachelorstudies and during basic studies in process technology focus was laid on the description/analysis of different physical phenomena. Their linkage in the course of selection, dimensioning, interconnection and optimization of apparatuses/ machines and their integration during process development will be outlined and illustrated by a variety of real-life examples.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

M**6.129 Module: Process Modeling in Downstream Processing [M-CIWVT-103066]**

Responsible: apl. Prof. Dr. Matthias Franzreb
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-106101 | Process Modeling in Downstream Processing | 4 CR | Franzreb |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are able to sum up and explain equilibrium and kinetic equations relevant for chromatography modeling. They are able to explain the methods used for determination of equilibrium and kinetic parameters and can discuss examples. They are familiar with the principle of complex downstream processes, e.g. simulated moving beds, and can explain the differences to conventional chromatography. Using commercial software they are able to simulate chromatography processes and to analyze the results. On this basis they can optimize process parameters and fit them in order to meet given targets such as purity or yield. They can evaluate different processes and choose the variant for a given task.

Content

Fundamentals and practical examples of chromatography modeling,
 Design rules for Simulated Moving Beds, Design of Experiments (DOE)

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 30 h

M**6.130 Module: Process Technology [M-CIWVT-104374]**

Responsible: Dr. Frederik Scheiff
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(mandatory\)](#)
[Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each term | 2 terms | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-106148 | Practical Course Process Technology and Plant Design | 0 CR | Scheiff |
| T-CIWVT-106149 | Initial Exam Process Technology and Plant Design | 0 CR | Scheiff |
| T-CIWVT-106150 | Process Technology and Plant Design Written Exam | 8 CR | Scheiff |

Competence Certificate

The module exam consists of three partial achievements:

- A written examination lasting 180 minutes
- A practical course in process and plant engineering, completed coursework
- An admission exam to the practical course process and plant engineering, completed coursework

Prerequisites

The admission exam is prerequisite for the practical course.

Competence Goal

The students are enabled to analyze technical processes and plants and describe the process on the basis of P&I-diagrams. They are capable to apply their engineering and process engineering basics on industrial processes and plants. They are prepared to design and evaluate process steps and process chains based on simplistic assumptions and characteristic numbers.

Content

- Engineering basics: P&I-diagram, flowsheet simulation, process optimization, safety, economical evaluation
- Application of engineering basics in practical course
- Process engineering in technical application, industrial production processes: e.g. steamcracker, methanol, sulfuric acid, ammonia, cement, pulp

Module grade calculation

The module grade is the grade of the written exam.

Workload

- Attendance time: 43 h
- Homework: 87 h
- Exam preparation: 80 h
- Internship: Attendance time: 9 h + preparation and follow-up time: 21 h

Literature

- *Ullmann's Encyclopedia of Industrial Chemistry*. Weinheim, Germany: Wiley-VCH Verlag GmbH & Co. KGaA, 2000. ISBN 9783527306732.
- **Baerns, M., et al.** *Technische Chemie.*, erw. Aufl. Weinheim: Wiley-VCH, 2013. ISBN 978-3-527-67409-1.
- **Weber, K.** *Engineering verfahrenstechnischer Anlagen. Praxishandbuch mit Checklisten und Beispielen*. Berlin: Springer Vieweg, 2014. SpringerLink : Bücher. ISBN 978-3-662-43529-8.
- **Perry, R., D. Green und J. Maloney.** *Perry's chemical engineer's handbook*. ed. New York: McGraw-Hill, 1999. ISBN 0-07-049841-5.
- **Levenspiel, O.** *Chemical reaction engineering*. 3rd ed. New York: Wiley, 1999. ISBN 047125424X.

M**6.131 Module: Processes and Process Chains for Renewable Resources [M-CIWVT-104422]**

Responsible: Prof. Dr. Nicolaus Dahmen
Prof. Dr.-Ing. Jörg Sauer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------------|
| T-CIWVT-108997 | Processes and Process Chains for Renewable Resources | 6 CR | Dahmen, Sauer |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

The students become able to:

- understand and assess the technical background of the key elements of process chains for the utilization of renewable resources,
- build up the ability for the development of process chains from biomass production via the conversion processes up to product design,
- apply the lessons learned to develop closed process chains for sustainable production of, as example, platform chemicals or material from renewable resources.

Content

The course comprises the following contents:

- Introduction to building a common knowledge base, among others the presentation of today's most important utilization pathway for biomass, biomass potentials, future usage scenarios,
- Essential technical fundamentals for biomass processing. The focus is on the use of lignocellulosic biomass. Procedures for pretreatment, biomass decomposition and separation as well as for conversion of the respective fractions are learned,
- Systematics and analysis of process chains with renewable raw materials based on already established processes such as paper or sugar mills. Extension of the concepts to possible future biorefineries,
- In the exercise, parallel to the lecture, the learned will be applied and implemented by development of an exemplary biorefinery. The results will be presented in a seminar.

Module grade calculation

The grade of the oral examination is the module grade.

M**6.132 Module: Processing of Nanostructured Particles [M-CIWVT-103073]**

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|---------|
| T-CIWVT-106107 | Processing of Nanostructured Particles | 6 CR | Nirschl |

Competence Certificate

Learning control is an oral examination lasting approx. 25 minutes.

Prerequisites

None

Competence Goal

Ability to design a process technology for the manufacturing and production of nanoscale particles

Content

Development of technical process in particle engineering; particle characterisation, interface engineering, particle synthesis;
 Typical processes: grinding, mixing, granulation, selective separation,
 classifying; fundamentals of apparatus and devices; simulation techniques, simulation tools

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 60 h
- Exam Preparation: 60 h

Literature

Skriptum zur Vorlesung

M**6.133 Module: Product Development – Methods of Product Engineering [M-MACH-102718]****Responsible:** Prof. Dr.-Ing. Albert Albers**Organisation:** KIT Department of Mechanical Engineering**Part of:** Technical Supplement Course**Credits**
6**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German/English**Level**
4**Version**
3

| Mandatory | | | |
|---------------|---|------|------------------------------|
| T-MACH-109192 | Methods and Processes of PGE - Product Generation Engineering | 6 CR | Albers, Burkardt, Matthiesen |

Competence Certificate

See course ("Teilleistung")

Prerequisites

None

Competence Goal

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.

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

Rationalization within the Product Development: Basics of Development

Management/ Simultaneous Engineering and Integrated Product Development/Development of Product

Lines and Modular Construction Systems

Quality Assurance in early Development Phases : Methods of Quality Assurance in an overview/QFD/FMEA

Workload

1. Time of presence lecture: 15 * 3h= 45 h

2. Prepare/follow-up lecture: 15 * 4,5 h = 67,5 h

3. Time of presence exercise: 4 * 1,5h = 6 h

4. Prepare/follow-up exercise: 4 * 3 h = 12 h

5. Exam preparation and time of presence: 49,5 h

Total: 180 h = 6 LP

Learning type

Lecture

Tutorial

Literature

Lecture documents

Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997

Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag, 1993

M**6.134 Module: Production and Development of Cancer Therapeutics [M-CIWVT-106563]****Responsible:** PD Dr. Gero Leneweit**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Biopharmaceutical Process Engineering](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-113230 | Production and Development of Cancer Therapeutics | 4 CR | Leneweit |

Competence Certificate

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

Prerequisites

None

Competence Goal

Students acquire skills to autonomously analyse the product requirements of active substances and drug formulations and to independently plan and realise manufacturing technologies for drug substances and carrier systems.

Content

- Risk factors and stages of carcinogenesis
- therapeutic targets
- mechanisms of chemotherapies, immunotherapies, DNA and RNA therapies
- mechanisms of therapy resistance and overcoming strategies
- drug delivery systems and manufacturing technologies
- scaling; drug loading and coating
- industrial processes
- targeted cancer therapies
- receptors and ligands
- drug accumulation
- (pre-) clinical testing
- regulatory and economic aspects
- innovation potentials and application perspectives

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 hrs
- Self-study: 60 hrs
- Exam preparation: 30 hrs

Literature

Lecture notes with references and topic-specific literature recommendations

M

6.135 Module: Reaction Kinetics [M-CIWVT-104283]**Responsible:** Dr.-Ing. Steffen Peter Müller**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Specialized Course I / Chemical Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|--------|
| T-CIWVT-108821 | Reaction Kinetics | 6 CR | Müller |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to discuss the cause and the differing elementary steps of homogen reactions, and they are qualified to calculate rate coefficients from experimental studies/data. Because of various examples, students can identify and analyse reactions by different elementary steps and they are capable to evaluate homogen reactions critically.

Content

Basics: transition state theory, thermodynamics and the relationship to kinetics, active sites and chain reactions.

Application: photochemistry, reactions in solution, polyreactions, autocatalysis and explosions.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 34 h
- Homework: 16 h
- Exam Preparation: 130 h

M**6.136 Module: Reactor Modeling with CFD [M-CIWVT-106537]****Responsible:** Prof. Dr.-Ing. Gregor Wehinger**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)
[Specialized Course I / Chemical Process Engineering](#) (Usage from 4/1/2024)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
English**Level**
4**Version**
1

| Mandatory | | | |
|----------------|---|------|----------|
| T-CIWVT-113224 | Reactor Modeling with CFD | 4 CR | Wehinger |

Competence Certificate

Learning control is an examination of another type: presentation and term paper.

Prerequisites

None

Competence Goal

The students are able to

- describe and apply the mathematical and physical principles of computational fluid dynamics (CFD),
- use the commercial CFD software STAR-CCM+ independently and thoroughly (preprocessing, solving, postprocessing),
- develop a CFD reactor model for an unknown chemical process engineering problem and investigate alternative reactor designs based on this model,
- analyze and evaluate the results obtained, also using virtual reality (VR),
- identify and evaluate errors and uncertainties in CFD models,
- visualize, present, and critically discuss their CFD results in the form of a final report.

Content

1. Conservation laws for momentum, mass and energy
2. The Finite-Volume-Method, solution algorithms, and boundary conditions
3. Computational meshes
4. CFD- Modelling of chemical reactors
5. Use of virtual reality in CFD
6. Basics of writing a scientific paper

Module grade calculation

The module grade is the grade of the examination of another type.

Workload

- Attendance time: 45 h
- Self-study: 45 h
- Exam preparation: 30 h

Literature

- Ferziger, Perić: Numerische Strömungsmechanik; 2020 ; Springer
- Versteeg, Malalasekera; An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd Edition); 2007; Pearson

M**6.137 Module: Refinery Technology - Liquid Fuels [M-CIWVT-104291]**

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-------|
| T-CIWVT-108831 | Refinery Technology - Liquid Fuels | 6 CR | Rauch |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).
The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are enabled to balance modern processes for the production of liquid fuels and to put them into context of a modern refinery. This knowledge can be transferred to the evaluation and the development of other processes.

Content

Introduction to liquid chemical fuels: sources, resources/reserves, consumption, characteristic properties of raw materials and products, overview of conversion processes.

Petroleum and petroleum refining: characterization of petroleum crude oils and refinery products, physical separation processes, chemical conversion/upgrading processes (chemical equilibrium, reaction technology etc.), refinery structures.

Non-conventional liquid fuels e. g. from synthesis processes or biomass feedstocks (vegetable oil and derived fuels, alcohols, synthetic liquid fuels).

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 75 h
- Exam Preparation: 60 h

Literature

- Elvers, B. (Ed.): Handbook of Fuels, Energy Sources for Transportation, Wiley VCH 2008.
- Lucas, A. G. (Ed.): Modern Petroleum Technology, Vol. 2 Downstream, John Wiley 2000.
- Gary, J.; Handwerk, G., Kaiser, M. J.: Petroleum Refining, Technology and Economics, Fifth Edition, CRC Press 2007

M**6.138 Module: Refrigeration B - Foundations of Industrial Gas Processing [M-CIWVT-104354]**

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Thermal Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|----------|
| T-CIWVT-108914 | Refrigeration B - Foundations of Industrial Gas Processing | 6 CR | Grohmann |

Competence Certificate

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

Prerequisites

None

Competence Goal

Understanding the principles of different processes for gas liquefaction and gas separation; Analysing processes in order to reveal the sources of energy demand; Applying the principles of thermodynamics of mixtures and analysing the states of fluids in rectification columns; Assessing the potential of technical concepts from a thermodynamic point of view

Content

Gas liquefaction processes, process analyses, refrigerators and mixed-refrigerant cycles, gas separation by low-temperature rectification, air separation and extraction of noble gases, processing and separation of natural gas, ethylene production, processing of H₂-enriched gas mixtures, storage and transport of liquefied gases

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 45 h
- Exam Preparation: 90 h

M**6.139 Module: Rheology and Processing of Disperse Systems [M-CIWVT-104336]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each term | 2 terms | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-------------------------------|
| T-CIWVT-108891 | Rheology and Processing of Disperse Systems | 8 CR | Oelschlaeger, Willenbacher |

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 140 h
- Exam Preparation: 40 h

M**6.140 Module: Rheology and Processing of Polymers [M-CIWVT-104335]**

Responsible: Dr.-Ing. Bernhard Hochstein
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage until 9/30/2025)
[Specialized Course I / Applied Rheology](#) (Usage until 9/30/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|----------------------------|
| T-CIWVT-108890 | Rheology and Processing of Polymers | 8 CR | Hochstein, Willenbacher |

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Annotation

The module is being phased out. Examinations can be taken until 30.09.2025.

Workload

- Attendance time (Lecture): 60 h
- Homework: 140 h
- Exam Preparation: 40 h

M**6.141 Module: Rheology and Rheometry [M-CIWVT-104326]**

Responsible: Dr.-Ing. Bernhard Hochstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage until 9/30/2025)
[Specialized Course I / Applied Rheology](#) (Usage until 9/30/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|-----------|
| T-CIWVT-108881 | Rheology and Rheometry | 4 CR | Hochstein |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Annotation

The Course is being phased out. The lecture will be offered for the last time in summer term 2025. Examinations can be taken until 30.09.2025.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.142 Module: Rheology of Complex Fluids and Advanced Rheometry [M-CIWVT-104331]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|-------------------------------|
| T-CIWVT-108886 | Rheology of Complex Fluids and Advanced Rheometry | 4 CR | Oelschlaeger, Willenbacher |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.143 Module: Rheology of Disperse Systems [M-CIWVT-104391]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)

Credits
2

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|--|------|--------------|
| T-CIWVT-108963 | Rheology of Disperse Systems | 2 CR | Willenbacher |

Prerequisites

None

Workload

- Attendance time (Lecture): 15h
- Homework: 35 h
- Exam Preparation: 10 h

M**6.144 Module: Rheology of Polymers [M-CIWVT-104329]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--------------------------------------|------|--------------|
| T-CIWVT-108884 | Rheology of Polymers | 4 CR | Willenbacher |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.145 Module: Seminar [M-MATH-103276]****Responsible:** PD Dr. Stefan Kühnlein**Organisation:** KIT Department of Mathematics**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2021)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2021)**Credits**
3**Grading scale**
pass/fail**Recurrence**
Each term**Duration**
1 term**Language**
German**Level**
5**Version**
1

| Mandatory | | | |
|---------------|-------------------------------------|------|--|
| T-MATH-106541 | Seminar Mathematics | 3 CR | |

Competence Certificate

The control of success (pass/fail) is based on a seminar talk lasting at least 45 minutes.

Prerequisites

none

Competence Goal

At the end of the module the participants should

- have analyzed a specific problem in a mathematical area
- be able to discuss subject-specific problems in the given context and present as well as defend them, using suitable media
- have summarized the most relevant results of their topic
- have communicative, organizational and didactic skills in complex problem analyses at their disposal. They can use techniques of scientific work.

Content

The specific content is based on the seminar topics being offered.

Module grade calculation

omitted as ungraded (pass/fail)

Workload

Total work load: 90 hours

Attendance: 30 hours

Self studies: 60 hours

- Preparation of the scientific content of the talk
- Preparation of a didactical concept for the talk
- Preparation of the presentation (blackboard, beamer, etc.)
- getting practice for the talk, creating a hand-out

M**6.146 Module: Seminar of Food Processing in Practice [M-CIWVT-105932]****Responsible:** Dr.-Ing. Nico Leister**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2022)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 2 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|---------|
| T-CIWVT-109129 | Seminar of Food Processing in Practice with Excursion | 2 CR | Leister |

Competence Certificate

Learning control is an oral exam with a duration of about 20 minutes.

Competence Goal

Students are able to use their academic knowledge on the processing and characterization of food products to evaluate industrially relevant food processes and techniques. In teams, they can discuss and solve complex tasks that concern the production and evaluation of food products and that stem from industrial applications. Students have the skills to present the results of their work in a scientific manner.

Content

Current challenges in the industrial production of selected food products will be discussed in small groups, and presented to the whole class. The seminar will be accompanied by an excursion to the relevant food processing plants.

Workload

- Attendance time: 30 h
- Self study: 15 h
- Exam preparation: 15 h

M**6.147 Module: Simulation Technologies [M-CIWVT-107038]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2025)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 4/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-114104 | Simulation Technologies - Exam | 3 CR | Meurer |
| T-CIWVT-114141 | Simulation Technologies - Prerequisite | 3 CR | Meurer |

Competence Certificate

The Learning control consists of two partial achievements:

1. Examination of another type.
2. Oral examination lasting approx. 45 minutes.

Prerequisites

None

Module grade calculation

The module grade ist the CP-weighted average of the two partial achievements.

Workload

Attendance time 45 hrs:

- Lectures 30 hrs
- Exercises 15 hrs

Homework 135 hrs:

- Programming task an written elaboration: 30 hrs
- Preparation/ wrap-up of lectures and exercises: 45 hrs
- Exam preparation: 60 hrs

Literature

- Vorlesungsunterlagen
- Schwarz, H.R.; Köckler, N.: Numerische Mathematik, Vieweg+Teubner Verlag Wiesbaden, 2011
- Hoffmann, J.: MATLAB und SIMULINK. Beispielorientierte Einführung in die Simulation dynamischer Systeme. Addison-Wesley 1998

M**6.148 Module: Single-Cell Technologies [M-CIWVT-106564]****Organisation:** KIT Department of Chemical and Process Engineering**Part of:** **Technical Supplement Course** (Usage from 10/1/2023)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|--------------------------|------|------------|
| T-CIWVT-113231 | Single-Cell Technologies | 4 CR | Grünberger |

Competence Certificate

The learning control is an oral examination lasting approx. 30 minutes.

Prerequisites

None

Competence Goal

Upon completion of the course, the students are able to:

- Know the fields and interdisciplinary nature of single-cell technologies
- Know basic methods in the field of single-cell technologies
- Are able to evaluate single-cell technologies
- Are able to choose single-cell platforms for specific biological questions
- Are aware of the complexity of the development of single-cell technologies

Content

While cell populations have historically been viewed as homogeneously behaving individuals, new research shows that cell-to-cell heterogeneity exists in all scales of biological systems. While most measurements are based on averages, individual cells can show dramatic differences in their properties such as growth, division and metabolic activity. Single-cell technologies have revolutionized our ability to delve into the intricacies of biological systems. By allowing the analysis of individual cells, these cutting-edge techniques provide insights into cellular heterogeneity, rare cell populations, and dynamic processes. Single-cell technologies range from single-cell microscopy, single-cell omics to single-cell cultivation, which all can be used to uncover hidden layers of complexity of a variety of cell types. These technologies have emerged in the last years and show a transformative, maybe revolutionizing, potential in many fields of basic and applied research of various scientific disciplines. This ranges from microbiology, biomedical research, drug discovery, biotechnology and bioprocess engineering.

The "Single-cell technologies" lecture aims to give an introduction and overview into single-cell technologies and provide students with a comprehensive understanding of the fundamental principles and practical applications of single-cell research. After a short introduction into the field, students will explore various single-cell technologies. Focus will be given on emerging field of microfluidic single-cell cultivation methods and their application. The characteristic features and functionality of selected systems are explained using current examples from science and research. Possibilities for applications in biotechnology and microbiology are discussed. The last part of the lecture provides an insight into single-cell data analysis and future challenges within the field. The course emphasizes the importance of uncovering cellular heterogeneity, and students will discover the role of these technologies in microbiology and biotechnology. They will stay updated on emerging trends and emerging application of this technically complex, but fast developing field. The interdisciplinary nature of single-cell technologies will be emphasized, fostering effective collaboration across fields. State of the art knowledge will be supported by insights into emerging fields and topics within the field. Upon completion, students will be well-prepared to contribute to cutting-edge research and innovations of single-cell technologies. The interdisciplinary and application-oriented lecture is aimed at technically interested students of molecular biotechnology, microbiology, biochemistry, bioprocess engineering, chemical engineering as well as all interested students of life sciences, chemistry, and physics.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

- Attendance time: 30 hrs
- Self-study: 50 hrs
- Exam preparation: 40 hrs

Literature

No specific textbook is recommended.

M**6.149 Module: Sol-Gel Processes [M-CIWVT-104489]**

Responsible: Dr.-Ing. Steffen Peter Müller
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)
[Specialized Course I / Mechanical Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|--------|
| T-CIWVT-108822 | Sol-Gel Processes | 4 CR | Müller |

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students are capable to describe and analyse the complete process from the starting material (sol) to the finished product (gel), like ceramics.

They are qualified to evaluate and estimate every single step of the entire process critically.

Content

Production of functional material via the sol-gel-process: hydrolyse and condensation, the gel-building process (gelation) and aging, deformation and rheology, drying-process, structure of aero- and xerogels, surface-chemistry and modification of the surface and finally sintering. Applications: powder, ceramics, glass, membranes and coatings.

Workload

- Attendance time (Lecture): 22,5 h
- Homework: 16 h
- Exam Preparation: 80 h

M**6.150 Module: Sol-Gel-Processes (Including Practical Course) [M-CIWVT-104284]**

Responsible: Dr.-Ing. Steffen Peter Müller
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Chemical Process Engineering](#)
[Specialized Course I / Mechanical Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-108822 | Sol-Gel Processes | 4 CR | Müller |
| T-CIWVT-108823 | Practical Course Sol-Gel Processes | 2 CR | Müller |

Competence Certificate

The examination consists of:

1. Oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).
2. Ungraded Laboratory work (section 4 subsection 3 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to describe and analyse the complete process from the starting material (sol) to the finished product (gel), like ceramics.

They are qualified to evaluate and estimate every single step of the entire process critically.

Content

Production of functional material via the sol-gel-process: hydrolyse and condensation, the gel-building process (gelation) and aging, deformation and rheology, drying-process, structure of aero- and xerogels, surface-chemistry and modification of the surface and finally sintering. Applications: powder, ceramics, glass, membranes and coatings.

Workload

- Attendance time (Lecture): 22,5 h
- Internship: 11,5 h, 4 attempts
- Homework: 16 h
- Exam Preparation: 130 h

M**6.151 Module: Solid Liquid Separation [M-CIWVT-104342]**

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)
[Specialized Course I / Bioresource Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 8 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|-------|
| T-CIWVT-108897 | Solid Liquid Separation | 8 CR | Gleiß |

Competence Certificate

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

Prerequisites

None

Competence Goal

The students are able to apply the fundamental laws and the derived physical principles of the particle separation from liquids and not only to relate them to the principally suited separation apparatuses but also special variants. They have the ability to apply the relationship between product operation and design parameters to different separation techniques. They can analyse separation problems with scientific methods and give alternative problem solution proposals.

Content

physical fundamentals, apparatuses, applications, strategies; characterisation of particle systems and slurries; pretreatment methods to enhance the separability of slurries; fundamentals, apparatuses and process technology of static and centrifugal sedimentation, flotation, depth filtration, crossflow filtration, cake forming vacuum and gas overpressure filtration, filter centrifuges and press filters; filter media; selection criteria and scale-up methods for separation apparatuses and machines; apparatus combinations; case studies to solve separation problems

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 80 h
- Exam Preparation: 100 h

Literature

Anlauf: Skriptum "Mechanische Separationstechnik - Fest/Flüssig-Trennung"

M**6.152 Module: Stability of Disperse Systems [M-CIWVT-104330]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Entrepreneurship in Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 4 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|---|------|--------------|
| T-CIWVT-108885 | Stability of Disperse Systems | 4 CR | Willenbacher |

Competence Certificate

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

The duration of the examination differs in the case of a specialized subject comprehensive examination and is approximately 15 minutes.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 70 h
- Exam Preparation: 20 h

M**6.153 Module: Statistical Thermodynamics [M-CIWVT-103059]**

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Thermal Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 6 | Grade to a tenth | Each summer term | 1 term | German/English | 4 | 3 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-106098 | Statistical Thermodynamics | 6 CR | Enders |

Competence Certificate

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

Prerequisites

Thermodynamics III

Modeled Conditions

The following conditions have to be fulfilled:

1. The module [M-CIWVT-103058 - Thermodynamics III](#) must have been passed.

Competence Goal

The students are able to understand the basics of statistical mechanics and they are able to recognize the advantage and disadvantage for application in chemical engineering.

Content

Boltzmann-method, Gibbs-method, real gases, equations of state, polymers

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

If required, the course will be offered in English.

Literature

- J. Blahous, Statistische Thermodynamik, Hirzel Verlag Stuttgart, 2007.
- H.T. Davis, Statistical Mechanics of Phases, Interfaces, and Thin Films, Wiley-VCH, New York, 1996.
- G.G. Gray, K.E. Gubbins, Theory of Molecular Fluids Fundamentals. Clarendon, Press Oxford, 1984.
- J.P. Hansen, I.R. McDonald, Theory of Simple Liquids with Application to Soft Matter. Fourth Edition, Elsevier, Amsterdam, 2006.
- G.H. Findenegg, T. Hellweg, Statistische Thermodynamik, 2. Auflage, Springer Verlag, 2015.
- J.O. Hirschfelder, C.F. Curtis, R.B. Bird, Molecular Theory of Gases and Liquids. John-Wiley & Sons, New York, 1954.

M**6.154 Module: Students Innovation Lab [M-CIWVT-106017]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Specialized Course I / Entrepreneurship in Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 12 | Grade to a tenth | Each winter term | 2 terms | German/English | 5 | 5 |

| Mandatory | | | |
|--|---|------|--------------|
| T-WIWI-102864 | Entrepreneurship | 3 CR | Terzidis |
| T-WIWI-110166 | SIL Entrepreneurship Project | 3 CR | Terzidis |
| Innovation Project (Election: 6 credits) | | | |
| T-CIWVT-112201 | Innovation Project Porous Ceramics from the 3D Printer | 6 CR | Willenbacher |
| T-CIWVT-113226 | Innovation Project Electronic Devices from Printable Conductive Materials | 6 CR | Willenbacher |

Competence Certificate

The learning control consists of three partial achievements:

- written examination on the lecture entrepreneurship lasting 60 minutes
- examination of another type: SIL entrepreneurship project: Term paper and presentation
- examination of another type: Innovation project

Prerequisites

None.

Competence Goal

The students will be introduced to the field 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.

On the basis of known engineering knowledge, students are able to independently develop technical prototypes for the market launch of an innovation. They are capable to develop a project plan from idea to implementation. They transfer process engineering knowledge to user-convincing product innovations. Students can analyze and evaluate important economic aspects. They are able to create concepts for the procurement of raw materials and the scaling of product manufacturing to the relevant industrial scale. They know how to develop market and cost analyses as well as marketing and sales strategies. Students are able to present their product clearly and convincingly to potential customers in the form of a pitch deck.

Content

Lecture Entrepreneurship

The lecture Entrepreneurship introduces the basic concepts of entrepreneurship. The individual stages of dynamic business development are covered. Emphasis is placed on the introduction to methods for generating innovative business ideas, translating patents into business concepts, and general principles of business planning. Further contents are the conception and use of service-oriented information systems for founders, technology management and business model generation as well as lean startup methods for the implementation of business ideas by way of controlled experiments in the market.

Students Innovation Lab: One of several projects can be selected:

- **Innovation project Porous ceramics from the 3D printer**

Porous ceramics can be used in a variety of ways, for example as:

- Hot gas filters for industrial processes
- Drinking water filters for the removal of contaminants such as heavy metals or viruses
- Catalyst supports for the degradation of pollutants, environmental remediation or hydrogen production
- Lightweight materials with high specific strength and temperature resistance
- Biomimetic materials, e.g. as bone substitutes

In this innovation project you will develop a prototype consisting of an innovative porous ceramic and document its technical feasibility. You will develop a concept for industrial-scale production and plan marketing. For this purpose, you will conduct a market analysis and develop a business model including price calculation, cost and financial planning as well as marketing and sales strategy.

- **Innovation Project Electronic Devices from Printable Conductive Materials**

Printable, conductive materials can be turned into electronic devices in a variety of ways, for example:

- by means of screen printing processes:
 - Mass production of electrical circuits
 - Contacting of solar cells
- via 3D printing:
 - Applications in the Smart and IoT sectors
 - Rapid Prototyping
 - Integration of complex electrical structures in the component without additional process steps
- In this innovation project, you will develop a prototype of an electrical device that is produced with the help of a printable, conductive material and document its technical feasibility. You will develop a concept for industrial-scale production and plan marketing. For this purpose, you will conduct a market analysis and develop a business model including price calculation, cost and financial planning as well as marketing and sales strategy.

Module grade calculation

The module grade is the CP-weighted average of the three partial achievements.

Workload

Entrepreneurship und SIL-Project

- Attendance time: 30 hrs
- Self-study: 80 hrs
- Exam preparation: 30 hrs
- Preparation of the presentation: 40 hrs

Innovation Project

- Attendance time: 100 hrs
- Self-study: 40 hrs
- Exam preparation (term paper and presentation): 40 hrs

Learning type

The two parts SIL Entrepreneurship Project and Innovation Project can only be carried out together in the same semester.

Literature

- Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship.
- Ries, Eric (2011): The Lean Startup.
- Osterwalder, Alexander (2010): Business Model Generation.

M**6.155 Module: Supplementary Studies on Science, Technology and Society [M-FORUM-106753]**

Responsible: Dr. Christine Mielke
Christine Myglas

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

Part of: **Additional Examinations** (Usage from 10/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------|----------|----------|-------|---------|
| 16 | Grade to a tenth | Each term | 3 terms | German | 3 | 1 |

Election notes

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

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

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

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

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

Competence Certificate

The monitoring is explained in the respective partial achievement.

They are composed of:

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

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

Prerequisites

The course is offered during the course of study and does not have to be completed within a defined period. Enrollment is required for all assessments of the modules in the supplementary studies.

Participation in the supplementary studies is regulated by § 3 of the statutes. KIT students register for the supplementary studies by selecting this module in the student portal and booking a performance themselves. Registration for courses, assessments, and exams is regulated by § 8 of the statutes and is usually possible shortly before the start of the semester.

The course catalog, module description (module manual), statutes (study regulations), and guidelines for creating the various written performance requirements can be downloaded from the FORUM homepage at <https://www.forum.kit.edu/begleitstudium-wtg.php>.

Registration and exam modalities**PLEASE NOTE:**

Registration on the FORUM, i.e. additionally via the module selection in the student portal, enables students to receive up-to-date information about courses or study modalities. In addition, registering on the FORUM ensures that you have proof of the credits you have earned. As it is currently (as of winter semester 24-25) not yet possible to continue additional credits acquired in the Bachelor's programme electronically in the Master's programme, we strongly advise you to digitally secure the credits you have earned by archiving the Bachelor's transcript of records yourself and by registering on FORUM.

In the event that a transcript of records of the Bachelor's certificate is no longer available - we can only assign the achievements of registered students and thus take them into account when issuing the certificate.

Competence Goal

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

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

Content

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

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

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

The 3 thematic subject areas:

Subject area 1: About Knowledge and Science

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

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

Subject area 2: Science in Society

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

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

Subject area 3: Science in Public Debates

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

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

Supplementary credits:

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

Module grade calculation

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

Annotation

Climate change, biodiversity crisis, antibiotic resistance, artificial intelligence, carbon capture and storage, and gene editing are just a few areas where science and technology can diagnose and address numerous social and global challenges. The extent to which scientific findings are considered in politics and society depends on various factors, such as public understanding and trust, perceived opportunities and risks, and ethical, social, or legal considerations.

To enable students to use their expertise as future decision-makers in solving social and global challenges, we aim to equip them with the skills to navigate the interfaces between science, business, and politics competently and reflectively. In the Supplementary Studies, they acquire foundational knowledge about the interactions between science, technology, and society.

They learn:

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

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

Workload

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

- Basic Module approx. 120 hours
- Advanced Module approx. 390 hours
- > Total: approx. 510 hours

In the form of supplementary services, up to approximately 390 hours of work can be added.

Recommendation

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

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

Learning type

- Lectures
- Seminars/Project Seminars
- Workshops

M**6.156 Module: Thermal Process Engineering II [M-CIWVT-107039]**

Responsible: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(CIW\)](#) (Usage from 4/1/2025)
[Technical Supplement Course](#) (Usage from 4/1/2025)

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-114107 | Thermal Process Engineering II | 6 CR | Zeiner |

M**6.157 Module: Thermal Process Engineering III [M-CIWVT-107040]****Responsible:** Prof. Dr.-Ing. Tim Zeiner**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2025)[Specialized Course I / Thermal Process Engineering](#) (Usage from 10/1/2025)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 5 | 1 |

| Mandatory | | | |
|----------------|---|------|--------|
| T-CIWVT-114108 | Thermal Process Engineering III | 6 CR | Zeiner |

M**6.158 Module: Thermodynamics III [M-CIWVT-103058]**

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(CIW\)](#)
[Technical Supplement Course](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|------------------------------------|------|--------|
| T-CIWVT-106033 | Thermodynamics III | 6 CR | Enders |

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

Competence Goal

Students are familiar with the basic principles for the description of complex, multicomponent mixtures and thermodynamic equilibria including equilibria with chemical reactions. They are able to select suitable models and to calculate the properties of multicomponent real systems.

Content

Phase- and reaction equilibria of real systems, equations of state for real mixtures, models for activity coefficients, polymer solutions, protein solutions, electrolyte solutions.

Module grade calculation

The module grade is the grade of the written exam.

Workload

- Attendance time (Lecture): 60 h
- Homework: 90 h
- Exam Preparation: 30 h

Literature

1. Stephan, P., Schaber, K., Stephan, K., Mayinger, F.: Thermodynamik, Band 2, 15. Auflage, Springer Verlag, 2010.
2. Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2008.
3. Gmehling, J., Kolbe, B., Kleiber, M., Rarey, J.: Chemical Thermodynamics for Process Simulations, Wiley-VCH Verlag, 2012

M**6.159 Module: Thermodynamics of Interfaces [M-CIWVT-103063]**

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------------|-------|---------|
| 4 | Grade to a tenth | Each summer term | 1 term | German/English | 4 | 1 |

| Mandatory | | | |
|----------------|--|------|--------|
| T-CIWVT-106100 | Thermodynamics of Interfaces | 4 CR | Enders |

Competence Certificate

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

Prerequisites

None

Competence Goal

The students to be familiar with the peculiarities on fluid-fluid and fluid-solid interfacial properties. They are able to calculate interfacial properties (interfacial tension, density - and concentration profiles, adsorption isotherms) using macroscopic and local-dependent methods.

Content

Gibbs-method, density functional theory, experimental methods for characterization of interfaces, adsorption

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

If required, the course will be offered in English.

M**6.160 Module: Vacuum Technology [M-CIWVT-104478]**

Responsible: Dr.-Ing. Thomas Giegerich
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Technical Thermodynamics](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | German | 4 | 1 |

| Mandatory | | | |
|----------------|-----------------------------------|------|-----------|
| T-CIWVT-109154 | Vacuum Technology | 6 CR | Giegerich |

Competence Certificate

The examination is an oral examination with a duration of 20 about minutes (section 4 subsection 2 number 2 SPO).

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students will be able to explain basic physical relationships in vacuum science. Building on this, they can design a complex vacuum system correctly and in accordance with specifications.

Content

Basics; vacuum pumps; practical vacuum limits; outgassing and its minimization; cleanliness requirements; vacuum instrumentation; total pressure measurement; residual gas analysis; leak detection; rarefied gas flow; design of vacuum systems; technical specifications; quality in vacuum; examples for large vacuum systems; industrial applications in the process industry.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 80 h
- Exam Preparation: 40 h

Learning type

22033 – Übung zu Vakuumtechnik

22034 – Vakuumtechnik

Literature

K. Jousten (Ed.) - Wutz Handbuch Vakuumtechnik, 11. Auflage, Springer, 2013.

M**6.161 Module: Wastewater Treatment Technologies [M-BGU-104917]**

Responsible: Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad
PD Dr.-Ing. Stephan Fuchs

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

Part of: **Technical Supplement Course** (Usage from 10/1/2022)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 4 |

| Mandatory | | | |
|--------------|--|------|----------------------------|
| T-BGU-109948 | Wastewater Treatment Technologies | 6 CR | Azari Najaf Abad, Fuchs |

Competence Certificate

- 'Teilleistung' T-BGU-109948 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

Students acquire knowledge about typical techniques and facilities in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs. Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content

Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany and abroad. They analyze, evaluate the applied technologies and take decisions when new and more holistic oriented methods can be implemented. Different mechanical, biological and chemical treatment technologies are considered, whereby the treatment of waste water from households and industry as well as the treatment of rainwater is discussed. The visit of at least one municipal wastewater treatment plant in Germany completes the course. The course includes lab work in groups to learn about basic measuring and analytical procedures in wastewater treatment plants.

Module grade calculation

grade of the module is grade of the exam

Annotation

The number of participants in the course is limited to 30 persons. The registration is to be made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 180 h

Recommendation

module 'Urban Water Infrastructure and Management'

Literature

ATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, Berlin

ATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn , Berlin

ATV-DVWK A 131 (2006): Bemessung von einstufigen Belebungsanlagen. Hefen, Germany.

Metcalf & Eddy, Abu-Orf, M., Bowden, G., Burton, F.L., Pfrang, W., Stensel, H.D., Tchobanoglous, G., Tsuchihashi, R. and AECOM (Firm), (2014). Wastewater engineering: treatment and resource recovery. McGraw Hill Education.

van Loosdrecht, M.C., Nielsen, P.H., Lopez-Vazquez, C.M. and Brdjanovic, D. eds., (2016). Experimental methods in wastewater treatment. IWA publishing.

M**6.162 Module: Water – Energy – Environment Nexus in a Circular Economy:
Research Proposal Preparation [M-CIWVT-106680]**

Responsible: Prof. Dr. Andrea Iris Schäfer
Organisation: KIT Department of Chemical and Process Engineering
Part of: **Technical Supplement Course** (Usage from 4/1/2024)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 5 | Grade to a tenth | Each summer term | 1 term | English | 5 | 1 |

| Mandatory | | | |
|----------------|--|------|--|
| T-CIWVT-113433 | Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation | 5 CR | |

Competence Certificate

The Learning control is an examination of another type:

Research proposal of 10 pages and an oral presentation of 10 minutes (individual work). The grade will be a composite of the proposal (submission in week 13 before class) and oral & poster presentation (all day workshop with researcher participation).

Competence Goal

The goal of this course is to get an overview of current challenges in the circular economy focused on the water – energy – environment nexus. Based on individual student interest a topic will be identified and a research plan developed encompassing a thorough background research to establish the state-of-the-art, identification of a specific research problem and research questions suitable to solve this problem. Concepts of novelty and excellence will be explored in an international context. Following the individual topic choice, the research proposal will be developed individually in a tutor group (divided into water, energy, environment) while lectures on required skills will accompany this process. As an outlook beyond this course, criteria to consider when looking for research careers such as applying for funding/scholarships, considering choices in research environment and supervision, performance indicators in research and university rankings will be introduced to enable informed decisions. The proposal will be communicated in writing, as a brief presentation and as a poster, which equips students brilliantly not only for a masters thesis but also a future research publication or a PhD.

Content

In a time of limiting resources, climate change and ever increasing demand for resources the concept of a circular economy is inevitable to create a more sustainable utilization of our key resources, water, energy and 'environment'. Concepts of zero liquid discharge, water reuse, carbon net zero, resource recovery and environmental pollution reduction are all part of this concept where waste is returned to use. The water – energy – environment nexus is the particular focus of this course. Global water issues, water and wastewater treatment, desalination, water reuse, micropollutants, decentralized systems, water & sanitation in international development, renewable energies, environmental pollution, climate change, resource recovery – and many more topics will inspire future research.

Module grade calculation

The module grade is the grade of the examination of another type.

Workload

- Contact time: lectures and tutorials 60 hrs (4 SWS)
- Group and self study: 50 hrs
- Preparation of assessments and participation at the group presentations (one full day): 30 hrs

M**6.163 Module: Water Technology [M-CIWVT-103407]****Responsible:** Prof. Dr. Harald Horn**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Water Technology](#)
[Specialized Course I / Environmental Process Engineering](#)

| Credits | Grading scale | Recurrence | Duration | Language | Level | Version |
|---------|------------------|------------------|----------|----------|-------|---------|
| 6 | Grade to a tenth | Each winter term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|----------------|----------------------------------|------|------|
| T-CIWVT-106802 | Water Technology | 6 CR | Horn |

Competence Certificate

Oral exam, 30 min

Prerequisites

None

Competence Goal

Students learn fundamental knowledge in water chemistry and how to apply it to processes in aquatic systems in general and in reactors for water treatment. Water treatment will be taught for drinking water and partly waste water. The students are able to apply physical, chemical and biochemical treatment for the respective removal of particulate and dissolved components in water. They are able to use the fundamental design parameters for the different types of unit operations.

Content

Water cycle, different types of raw water (ground and surface water). Water as solvent, carbonate balance, differentiation between microbiological and chemical population. Unit operations: sieving, sedimentation, filtration, flocculation, flotation, ion exchange, aeration, oxidation, disinfection, adsorption). For all unit operations design parameters will be provided. Simple 1D models will be discussed for description of kinetics and retention time in reactors for water treatment.

Workload

Attendance time: 45 h

Preparation/follow-up: 60 h

Examination + exam preparation: 75 h

Literature

Crittenden, J. C. et al. (2012): Water treatment – Principles and design. 3. edition, Wiley & Sons, Hoboken.

Jekel, M., Czekalla, C. (Hrsg.) (2016). DVGW Lehr- und Handbuch der Wasserversorgung. Deutscher Industrieverlag.

Lecture notes will be provided in ILIAS

7 Courses

T

7.1 Course: Model Development and Simulation in Thermal Process Engineering [T-CIWVT-113702]





Responsible: Prof. Dr.-Ing. Tim Zeiner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106832 - Model Development and Simulation in Thermal Process Engineering](#)

| Type | Credits | Grading scale | Version |
|-----------------------------|---------|------------------|---------|
| Examination of another type | 6 | Grade to a third | 1 |

| Events | | | | | |
|----------|---------|---|-------|--|--------|
| WT 24/25 | 2260160 | Model Development and Simulation in Thermal Process Engineering | 3 SWS | Project (P / ) | Zeiner |

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

Competence Certificate

Learning control is an examination of another type. Term paper (max 30 pages) and presentation (duration approx. 20 minutes).

Prerequisites

None.

Annotation

If required, the course will be offered in English.

T

7.2 Course: Additive Manufacturing for Process Engineering - Examination [T-CIWVT-110902]

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105407 - Additive Manufacturing for Process Engineering](#)


Type
Oral examination





Credits
5

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|-------|
| ST 2025 | 2241020 | Additive Manufacturing for Process Engineering | 2 SWS | Lecture /  | Klahn |
| Exams | | | | | |
| WT 24/25 | 7241020 | Additive Manufacturing for Process Engineering - Examination | | | Klahn |
| ST 2025 | 7293103 | Additive Manufacturing for Process Engineering - Examination | | | Klahn |

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

Competence Certificate

Oral examination with a duration of about 30 minutes.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-110903 - Practical in Additive Manufacturing for Process Engineering](#) must have been passed.

T

7.3 Course: Advanced Methods in Nonlinear Process Control [T-CIWVT-113490]

Responsible: Dr.-Ing. Pascal Jerono
Prof. Dr.-Ing. Thomas Meurer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106715 - Advanced Methods in Nonlinear Process Control](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|----------------|
| ST 2025 | 2243035 | Advanced Methods in Nonlinear Control | 2 SWS | Lecture /  | Meurer, Jerono |
| Exams | | | | | |
| WT 24/25 | 7243035 | Advanced Methods in Nonlinear Process Control | | | Meurer, Jerono |
| ST 2025 | 7243035 | Advanced Methods in Nonlinear Process Control | | | Meurer, Jerono |

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

T

7.4 Course: Air Pollution Control - Laws, Technology and Application [T-CIWVT-112812]

Responsible: Prof. Dr.-Ing. Achim Dittler

Organisation: KIT Department of Chemical and Process Engineering


Part of: [M-CIWVT-106314 - Air Pollution Control - Laws, Technology and Application](#)





Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|---------|
| ST 2025 | 2244040 | Clean Air - Laws, Technology and Application | 2 SWS | Lecture /  | Dittler |
| Exams | | | | | |
| WT 24/25 | 7244040 | Air Pollution Control - Laws, Technology and Application | | | Dittler |
| ST 2025 | 7244040 | Air Pollution Control - Laws, Technology and Application | | | Dittler |

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

T

7.5 Course: Alternative Protein Technologies [T-CIWVT-113429]

Responsible: PD Dr.-Ing. Azad Emin
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106661 - Alternative Protein Technologies](#)

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|---------|---------|--|-------|------------|------|
| ST 2025 | 2211330 | Alternative Protein Technologies | 2 SWS | Block / 🗓️ | Emin |
| Exams | | | | | |
| ST 2025 | 7211330 | Alternative Protein Technologies | Emin | | |

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

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None



T





7.6 Course: Applied Mass Transfer - Energy Systems and Thin Films [T-CIWVT-113692]

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106823 - Applied Mass Transfer - Energy Systems and Thin Films](#)

| Type | Credits | Grading scale | Version |
|------------------|---------|------------------|---------|
| Oral examination | 8 | Grade to a third | 1 |

| Events | | | | | |
|----------|---------|--|---------|--|--------------------------------------|
| WT 24/25 | 2260230 | Applied Mass Transfer – Energy Systems and Thin Films | 2 SWS | Lecture /  | Schabel, Scharfer, und Mitarbeitende |
| WT 24/25 | 2260231 | Exercises on 2260230 Applied Mass Transfer – Energy Systems and Thin Films | 2 SWS | Practice /  | Schabel, Scharfer, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7200061 | Applied Mass Transfer - Energy Systems and Thin Films | Schabel | | |
| WT 24/25 | 7260230 | Applied Mass Transfer - Energy Systems and Thin Films | Schabel | | |
| ST 2025 | 7200061 | Applied Mass Transfer - Energy Systems and Thin Films | Schabel | | |

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

Prerequisites

None.

T

7.7 Course: Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113579]

Responsible: Dr. Christine Mielke
Christine Myglas

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

Part of: [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|----------------------|---------|---------------|------------------|-----------|---------|
| Completed coursework | 2 | pass/fail | Each summer term | 1 terms | 1 |

Competence Certificate

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

Prerequisites

None

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

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

Recommendation

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

However, attending courses in the advanced unit before attending the basic seminar should be avoided.



Annotation



T

7.8 Course: Batteries and Fuel Cells [T-ETIT-100983]

Responsible: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: [M-ETIT-100532 - Batteries and Fuel Cells](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 6 | Grade to a third | Each winter term | 3 |

| Events | | | | | |
|----------|---------|--|-------|--|----------------|
| WT 24/25 | 2304207 | Batteries and Fuel Cells | 2 SWS | Lecture /  | Krewer |
| WT 24/25 | 2304213 | Batteries and Fuel Cells (Exercise to 2304207) | 1 SWS | Practice /  | Krewer, Sonder |
| Exams | | | | | |
| WT 24/25 | 7304207 | Batteries and Fuel Cells | | | Krewer |
| ST 2025 | 7300006 | Batteries and Fuel Cells | | | Krewer |


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





Prerequisites
 none

T

7.9 Course: Battery and Fuel Cells Systems [T-ETIT-100704]

Responsible: Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [M-ETIT-100377 - Battery and Fuel Cells Systems](#)**Type**
Oral examination**Credits**
3**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|-------|
| ST 2025 | 2304214 | Batterie- und Brennstoffzellensysteme | 2 SWS | Lecture /  | Weber |
| Exams | | | | | |
| WT 24/25 | 7304214 | Batteries and Fuel Cells Systems | | | Weber |
| ST 2025 | 7304214 | Batteries and Fuel Cells Systems | | | Weber |

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

T

7.10 Course: Biobased Plastics [T-CIWVT-109369]

Responsible: Prof. Dr. Ralf Kindervater
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104570 - Biobased Plastics](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------------|-----------------------------------|-------------|---|--------------------------------|
| WT 24/25 | 2212820 | Biobased Plastic | 2 SWS | Lecture /  | Kindervater, Syldatk, Schmiedl |
| Exams | | | | | |
| WT 24/25 | 7212820-VT-BK | Biobased Plastics | Kindervater | | |
| ST 2025 | 7212820-VT-BK | Biobased Plastics | Kindervater | | |

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

Competence Certificate

Vertiefungsfach:

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Technisches Ergänzungsfach or a large number of students:

The examination is a written examination with a duration of 90 minutes (section 4 subsection 2 number 1 SPO).

Prerequisites

None

T

7.11 Course: Biofilm Systems [T-CIWVT-106841]

Responsible: Dr. Andrea Hille-Reichel
Dr. Michael Wagner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-103441 - Biofilm Systems](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---------------------------------|-------|---|-----------------------------|
| ST 2025 | 2233820 | Biofilm Systems | 2 SWS | Lecture /  | Hille-Reichel, Wagner |
| Exams | | | | | |
| WT 24/25 | 7232617 | Biofilm Systems | | | Horn, Hille-Reichel, Wagner |
| ST 2025 | 7232617 | Biofilm Systems | | | Horn, Hille-Reichel, Wagner |

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

Competence Certificate

Oral exam, about 20 min.

T


7.12 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-100489 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine I](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 4 | Grade to a third | Each winter term | 2 |

| Events | | | | | |
|----------|------------------|--|-------|---|---------------|
| WT 24/25 | 2141864 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | 2 SWS | Lecture /  | Guber, Ahrens |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | | | Guber |
| ST 2025 | 76-T-MACH-100966 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I | | | Guber |

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

Competence Certificate

written exam (75 Min.)

Prerequisites

none

Workload

120 hours

T


7.13 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-100490 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine II](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 4 | Grade to a third | Each summer term | 2 |

| Events | | | | | |
|----------|------------------|---|-------|---|---------------|
| ST 2025 | 2142883 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 2 SWS | Lecture /  | Guber, Ahrens |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | | | Guber |
| ST 2025 | 76-T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | | | Guber |

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

Competence Certificate

Written exam (75 Min.)

Prerequisites

none

Workload

120 hours

T


7.14 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-100491 - BioMEMS - Microsystems Technologies for Life Sciences and Medicine III](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 4 | Grade to a third | Each summer term | 2 |

| Events | | | | | |
|----------|------------------|--|-------|---|---------------|
| ST 2025 | 2142879 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 2 SWS | Lecture /  | Guber, Ahrens |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | | | Guber |
| ST 2025 | 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



Workload





120 hours

T

7.15 Course: Biopharmaceutical Purification Processes [T-CIWVT-106029]

Responsible: Prof. Dr. Jürgen Hubbuch**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-103065 - Biopharmaceutical Purification Processes](#)**Type**
Written examination**Credits**
6**Grading scale**
Grade to a third**Version**
1

| Events | | | | | |
|----------|---------|---|-------|--|-------------------|
| WT 24/25 | 2214010 | Biopharmaceutical Purification Processes | 3 SWS | Lecture /  | Hubbuch, Franzreb |
| WT 24/25 | 2214011 | Exercises on 2214010 Biopharmaceutical Purification Processes | 1 SWS | Practice /  | Hubbuch, Franzreb |
| Exams | | | | | |
| WT 24/25 | 7223011 | Biopharmaceutical Purification Processes | | | Hubbuch |
| ST 2025 | 7223011 | Biopharmaceutical Purification Processes | | | Hubbuch |

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

The examination is a written examination with a duration of 120 minutes (section 4 subsection 2 number 1 SPO).

T

7.16 Course: Bioprocess Development [T-CIWVT-112766]



Responsible: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106297 - Bioprocess Development](#)





Type
Written examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|------------|
| ST 2025 | 2213020 | Bioprocess Development | 2 SWS | Lecture /  | Grünberger |
| ST 2025 | 2213021 | Bioprocess Development - Exercises | 2 SWS | Practice /  | Grünberger |
| Exams | | | | | |
| WT 24/25 | 7222001 | Bioprocess Development | | | Grünberger |
| ST 2025 | 7222001 | Bioprocess Development | | | Grünberger |

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

T

7.17 Course: Bioprocess Scale-up [T-CIWVT-113712]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106837 - Bioprocess Scale-up](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|-------------------------------------|-------|---|------------|
| WT 24/25 | 2213040 | Bioprocess Scale-Up | 2 SWS | Lecture /  | Grünberger |
| Exams | | | | | |
| WT 24/25 | 7213040 | Bioprocess Scale-up | | | Grünberger |
| ST 2025 | 7213040 | Bioprocess Scale-up | | | Grünberger |

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

T

7.18 Course: Bioreactor Development [T-CIWVT-113315]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106595 - Bioreactor Development](#)

Type
Completed coursework

Credits
3

Grading scale
pass/fail

Version
1

| Events | | | | | |
|---------|-------------|--|-------|-----------------|----------------------|
| ST 2025 | 2210020 | Team Project "99€ Bioreactor": Development of an Innovative Bioreactor Concept | 2 SWS | Project (P / 🧠) | Grünberger, Holtmann |
| Exams | | | | | |
| ST 2025 | 7210020-BRE | Bioreactor Development | | | Holtmann, Grünberger |

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

Prerequisites

None

T 7.19 Course: Biosensors [T-CIWVT-113714]

Responsible: Dr. Gözde Kabay
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106838 - Biosensors](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each term

Version
1

| Events | | | | | |
|----------|---------|----------------------------|-------|---|-------|
| WT 24/25 | 2214810 | Biosensors | 2 SWS | Lecture /  | Kabay |
| ST 2025 | 2214810 | Biosensors | 2 SWS | Lecture /  | Kabay |
| Exams | | | | | |
| WT 24/25 | 7200063 | Biosensors | | | Kabay |
| WT 24/25 | 7214810 | Biosensors | | | Kabay |
| ST 2025 | 7214810 | Biosensors | | | Kabay |

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

Prerequisites

None

T

7.20 Course: Biotechnological Production [T-CIWVT-113831]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104384 - Biotechnological Production](#)

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

| Exams | | | |
|----------|--------------|---|----------|
| WT 24/25 | 7212020-V-BS | Biotechnological Production | Holtmann |

Competence Certificate

Learning control is a written examination lasting 120 minutes.

Prerequisites

Seminar

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113830 - Seminar Biotechnological Production](#) must have been passed.


Recommendation





Knowledge in biochemistry, genetics, cell biology and microbiology is required.

T

7.21 Course: Biotechnological Use of Renewable Resources [T-CIWVT-113237]

Responsible: Prof. Dr. Christoph Syldatk**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-105295 - Biotechnological Use of Renewable Resources](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------------|---|-------|---|---------|
| WT 24/25 | 2212210 | Biotechnological Use of Renewable Resources | 2 SWS | Lecture /  | Syldatk |
| Exams | | | | | |
| WT 24/25 | 7212210-VT-BR | Biotechnological Use of Renewable Resources | | | Syldatk |
| ST 2025 | 7212210-VT-BR | Biotechnology in Bioeconomy | | | Syldatk |

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

The learning control is an oral examination lasting about 20 minutes.

Prerequisites

None

T

7.22 Course: C1-Biotechnology Exam [T-CIWVT-113677]



Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106816 - C1-Biotechnology](#)

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------------|---|---------|--|---------|
| WT 24/25 | 2212130 | C1-Biotechnology | 2 SWS | Lecture /  | Neumann |
| WT 24/25 | 2212131 | Exercises on 2212130 C1-Biotechnology | 1 SWS | Practice /  | Neumann |
| Exams | | | | | |
| WT 24/25 | 7212130-VL-C1 | C1-Biotechnology Exam | Neumann | | |

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

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113678 - C1-Biotechnology Presentation](#) must have been passed.

T

7.23 Course: C1-Biotechnology Presentation [T-CIWVT-113678]



Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106816 - C1-Biotechnology](#)





Type
Completed coursework

Credits
2

Grading scale
pass/fail

Version
2

| Events | | | | | |
|----------|---------------|---|---------|--|---------|
| WT 24/25 | 2212130 | C1-Biotechnology | 2 SWS | Lecture /  | Neumann |
| WT 24/25 | 2212131 | Exercises on 2212130 C1-Biotechnology | 1 SWS | Practice /  | Neumann |
| Exams | | | | | |
| WT 24/25 | 7212130-Pr-C1 | C1-Biotechnology Presentation | Neumann | | |

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

T

7.24 Course: Catalysis for Sustainable Chemicals and Energies [T-CIWVT-114167]

Responsible: Arik Malte Beck
 Prof. Dr. Jan-Dierk Grunwaldt
 Dr. Erisa Saraci
 Prof. Dr. Felix Studt
 TT-Prof. Dr. Moritz Wolf

Organisation: KIT Department of Chemical and Process Engineering


Part of: [M-CIWVT-107131 - Catalysis for Sustainable Chemicals and Energies](#)





Type
 Oral examination

Credits
 4

Grading scale
 Grade to a third

Version
 1




| Events | | | | | |
|---------|------|--|-------|---|--------------------------------------|
| ST 2025 | 5440 | Katalyse für nachhaltige chemische Produkte und Energieträger (Catalysis for sustainable chemicals and energies) | 2 SWS | Lecture /  | Saraci, Studt, Grunwaldt, Beck, Wolf |




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

T

7.25 Course: Catalytic Micro Reactors [T-CIWVT-109087]

Responsible: Prof. Dr.-Ing. Peter Pfeifer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104451 - Catalytic Micro Reactors](#)
[M-CIWVT-104491 - Catalytic Micro Reactors \(including practical course\)](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|---------------------------------------|
| WT 24/25 | 2220211 | Practical Course for 2220210 Catalytic Micro Reactors | 1 SWS | Practical course /  | Pfeifer, Dittmeyer, und Mitarbeitende |
| ST 2025 | 2220210 | Catalytic Micro Reactors | 2 SWS | Lecture /  | Pfeifer |
| ST 2025 | 2220211 | Catalytic Micro Reactors - Practical Course | 1 SWS | Practical course /  | Dittmeyer, Pfeifer, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7210211 | Catalytic Micro Reactors | | | Pfeifer |
| ST 2025 | 7210211 | Catalytic Micro Reactors | | | Pfeifer |

Legend:  Online,  Blended (On-Site/Online),  On-Site, X Cancelled**Competence Certificate**

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).


Prerequisites





None

T

7.26 Course: Catalytic Processes in Gas Technologies [T-CIWVT-108827]

Responsible: Dr.-Ing. Siegfried Bajohr**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104287 - Catalytic Processes in Gas Technologies](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|--------|
| ST 2025 | 2231520 | Catalytic Processes in Gas Technologies | 2 SWS | Lecture /  | Bajohr |
| Exams | | | | | |
| WT 24/25 | 7230017 | Catalytic Processes in Gas Technologies | | | Bajohr |
| ST 2025 | 7230017 | Catalytic Processes in Gas Technologies | | | Bajohr |

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

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.27 Course: Chemical Hydrogen Storage [T-CIWVT-113234]

Responsible: TT-Prof. Dr. Moritz Wolf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106566 - Chemical Hydrogen Storage](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|-------------|
| WT 24/25 | 2231420 | Chemical Hydrogen Storage | 2 SWS | Lecture /  | Wolf, Sauer |
| Exams | | | | | |
| WT 24/25 | 7231420 | Chemical Hydrogen Storage | Wolf | | |
| ST 2025 | 7231420 | Chemical Hydrogen Storage | Wolf | | |

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

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

T

7.28 Course: Chemical Process Engineering II [T-CIWVT-108817]

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104281 - Chemical Process Engineering II](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

| Events | | | | | |
|----------|---------|--|-------|--|----------|
| WT 24/25 | 2220020 | Chemical Process Engineering II | 2 SWS | Lecture /  | Wehinger |
| WT 24/25 | 2220021 | Exercises on 2220020 Chemical Process Engineering II | 1 SWS | Practice /  | Wehinger |
| Exams | | | | | |
| WT 24/25 | 7210104 | Chemical Process Engineering II | | | Wehinger |
| ST 2025 | 7210104 | Chemical Process Engineering II | | | Wehinger |

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

Competence Certificate

The examination is an oral examination with a duration of approx. 20 minutes.

Prerequisites

None

T

7.29 Course: Chem-Plant [T-CIWVT-109127]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104461 - Chem-Plant](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 4 | Grade to a third | Each summer term | 1 |

| Exams | | | |
|----------|---------|----------------------------|--------|
| WT 24/25 | 7200101 | Chem-Plant | Enders |
| ST 2025 | 7200101 | Chem-Plant | Enders |

Prerequisites

None

Recommendation

Thermodynamics III, Process Technology

T

7.30 Course: Circular Economy [T-CIWVT-113815]

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106881 - Circular Economy](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Exams | | | |
|---------|---------|--|-------|
| ST 2025 | 7232220 | Circular Economy - Oral Exam | Stapf |

Competence Certificate

The learning control is an oral examination on lectures, exercises and case studies, duration approx. 30 minutes.

Prerequisites

None.

T

7.31 Course: Combustion and Environment [T-CIWVT-108835]

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104295 - Combustion and Environment](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 2232020 | Combustion and Environment | 2 SWS | Lecture /  | Trimis |
| Exams | | | | | |
| WT 24/25 | 7231203 | Combustion and Environment | | | Trimis |
| ST 2025 | 7231203 | Combustion and Environment | | | Trimis |

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

Prerequisites

None

T

7.32 Course: Combustion Technology [T-CIWVT-106104]

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103069 - Combustion Technology](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|---------------------------|
| WT 24/25 | 2232010 | Fundamentals of Combustion Technology | 2 SWS | Lecture /  | Trimis |
| WT 24/25 | 2232011 | Exercises for 2232010 Fundamentals of Combustion Technology | 1 SWS | Practice /  | Trimis, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7231201 | Combustion Technology | | | Trimis |
| ST 2025 | 7231201 | Combustion Technology | | | Trimis |

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

Prerequisites

None

T

7.33 Course: Commercial Biotechnology [T-CIWVT-108811]

Responsible: Prof. Dr. Ralf Kindervater
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104273 - Commercial Biotechnology](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------------|--|-------------|---|--------------------------------|
| ST 2025 | 2212810 | Commercial Biotechnology | 2 SWS | Lecture /  | Kindervater, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7212810-VT-KB | Commercial Biotechnology | Kindervater | | |
| ST 2025 | 7212810-VT-KB | Commercial Biotechnology | Kindervater | | |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

In case of large number of participants the examination is a written examination with a duration of 60 minutes (section 4 subsection 2 number 1 SPO).

Prerequisites



None





T

7.34 Course: Computational Fluid Dynamics [T-CIWVT-106035]

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103072 - Computational Fluid Dynamics](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------|---------|
| Written examination | 6 | Grade to a third | Each term | 1 |

| Events | | | | | |
|----------|---------|--|-------|--|----------------------------|
| WT 24/25 | 2245020 | Computational Fluid Dynamics | 2 SWS | Lecture /  | Nirschl, und Mitarbeitende |
| WT 24/25 | 2245021 | Exercises for 2245020 Computational Fluid Dynamics | 1 SWS | Practice /  | Nirschl, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7291020 | Computational Fluid Dynamics | | | Nirschl |
| ST 2025 | 7291932 | Computational Fluid Dynamics | | | Nirschl |

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

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

T**7.35 Course: Computational Fluid Dynamics and Simulation Lab [T-MATH-113373]**

Responsible: Prof. Dr. Martin Frank
 PD Dr. Mathias Krause
 Dr. Stephan Simonis
 PD Dr. Gudrun Thäter

Organisation: KIT Department of Mathematics

Part of: [M-MATH-106634 - Computational Fluid Dynamics and Simulation Lab](#)

| Type | Credits | Grading scale | Version |
|-----------------------------|---------|------------------|---------|
| Examination of another type | 4 | Grade to a third | 1 |

| Events | | | | | |
|---------|---------|---|-------|------------------|-------------------------|
| ST 2025 | 0161700 | Computational Fluid Dynamics and Simulation Lab | 4 SWS | Practical course | Thäter, Krause, Simonis |

Prerequisites

none

Workload

120 hours

T

7.36 Course: Computer-Aided Reactor Design [T-CIWVT-113667]


Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106809 - Computer-Aided Reactor Design](#)





Type
Examination of another type

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|-----------------------------|
| WT 24/25 | 2220070 | Computer-Aided Reactor Design | 1 SWS | Lecture /  | Wehinger, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7220070 | Computer-Aided Reactor Design | | | Wehinger, Kutscherauer |

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

Competence Certificate

Learning control is an examination of another type: The written assignments are evaluated during the semester.


Prerequisites





None.

T

7.37 Course: Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids [T-CIWVT-108883]**Responsible:** Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104328 - Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids](#)

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

| Events | | | | | |
|----------|---------|---|-------|---|-----------|
| WT 24/25 | 2242250 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids | 2 SWS | Lecture /  | Hochstein |
| Exams | | | | | |
| WT 24/25 | 7290202 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids | | | Hochstein |
| ST 2025 | 7290202 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids | | | Hochstein |

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

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T**7.38 Course: Control of Distributed Parameter Systems [T-CIWVT-112826]**


Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106318 - Control of Distributed Parameter Systems](#)





Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 2243040 | Control of Distributed Parameter Systems | 3 SWS | Block /  | Meurer |
| Exams | | | | | |
| WT 24/25 | 7250002 | Control of Distributed Parameter Systems | | | Meurer |
| ST 2025 | 7243040 | Control of Distributed Parameter Systems | | | Meurer |

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

T

7.39 Course: Cryogenic Engineering [T-CIWVT-108915]

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104356 - Cryogenic Engineering](#)



Type
Oral examination


Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|----------|
| WT 24/25 | 2250140 | Cryogenic Engineering | 2 SWS | Lecture /  | Grohmann |
| WT 24/25 | 2250141 | Cryogenic Engineering - Exercises | 1 SWS | Practice /  | Grohmann |
| Exams | | | | | |
| WT 24/25 | 7250140 | Cryogenic Engineering | | | Grohmann |
| ST 2025 | 7200201 | Cryogenic Engineering | | | Grohmann |

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

T

7.40 Course: Data Analysis and Statistics [T-CIWVT-108900]

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104345 - Data Analysis and Statistics](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-----------|---|-----------|
| ST 2025 | 2245120 | Data Analysis and Statistics | 2 SWS | Lecture /  | Guthausen |
| Exams | | | | | |
| WT 24/25 | 7291120 | Data Analysis and Statistics | Guthausen | | |
| ST 2025 | 7291120 | Data Analysis and Statistics | Guthausen | | |

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

Competence Certificate

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

Prerequisites

None

T

7.41 Course: Data-Based Modeling and Control [T-CIWVT-112827]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106319 - Data-Based Modeling and Control](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third



Version
1





| Events | | | | | |
|----------|---------|---|--------|------------------------------|--------|
| WT 24/25 | 2243070 | Data-Based Modeling and Control | 3 SWS | Lecture / Practice (/ 🎧) | Meurer |
| Exams | | | | | |
| WT 24/25 | 7200009 | Data-Based Modeling and Control | Meurer | | |
| ST 2025 | 7243070 | Data-Based Modeling and Control | Meurer | | |

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

T**7.42 Course: Data-Driven Models in Python - Process Engineering Project [T-CIWVT-113708]****Responsible:** Dr.-Ing. Frank Rhein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106835 - Data-Driven Process Engineering Models in Python](#)

| Type | Credits | Grading scale | Version |
|----------------------|---------|---------------|---------|
| Completed coursework | 3 | pass/fail | 1 |

| Events | | | | | |
|----------|---------|--|-------|--|-------|
| WT 24/25 | 2245320 | Data-Driven Modeling with Python | 2 SWS | Lecture /  | Rhein |
| WT 24/25 | 2245321 | Project Work on 2245320 Data-Driven Modeling with Python | 1 SWS | Practice /  | Rhein |
| Exams | | | | | |
| WT 24/25 | 7291320 | Data-Driven Modeling with Python - Project | Rhein | | |

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

T**7.43 Course: Data-Driven Process Engineering Models in Python - Exam [T-CIWVT-113709]****Responsible:** Dr.-Ing. Frank Rhein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106835 - Data-Driven Process Engineering Models in Python](#)

| Type | Credits | Grading scale | Version |
|------------------|---------|------------------|---------|
| Oral examination | 1 | Grade to a third | 1 |

| Exams | | | |
|----------|---------|---|-------|
| WT 24/25 | 7245320 | Data-Driven Process Engineering Models in Python - Exam | Rhein |

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113708 - Data-Driven Models in Python - Process Engineering Project](#) must have been passed.

T

7.44 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-CIWVT-105206 - Design of a Jet Engine Combustion Chamber](#)


Type
Examination of another type





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|-------|
| WT 24/25 | 2232310 | Design of a Jet Engine Combustion Chamber | 2 SWS | /  | Harth |
| Exams | | | | | |
| WT 24/25 | 7232310 | Design of a Jet Engine Combustion Chamber | | | Harth |
| ST 2025 | 7232310 | Design of a Gas Turbine Combustor | | | Harth |

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

T

7.45 Course: Design of Micro Reactors [T-CIWVT-108826]

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104286 - Design of Micro Reactors](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|---------|------------------------------|---------|
| WT 24/25 | 2220220 | Design of Micro Reactors | 4 SWS | Lecture / Practice (/ ●) | Pfeifer |
| Exams | | | | | |
| WT 24/25 | 7210210 | Design of Micro Reactors | Pfeifer | | |
| ST 2025 | 7210210 | Design of Micro Reactors | Pfeifer | | |

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

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4, subsection 2, number 2 SPO).

Prerequisites

None

T

7.46 Course: Development of an Innovative Food Product [T-CIWVT-108960]

Responsible: Dr.-Ing. Ulrike van der Schaaf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104388 - Development of an Innovative Food Product](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------|---------|
| Examination of another type | 3 | Grade to a third | Each term | 2 |

| Events | | | | | |
|----------|---------|---|-------|------------------|-----------------------------------|
| ST 2025 | 2211220 | Team Project "Eco TROPHELIA": Development of an Innovative Food Product | 3 SWS | Project (P / 🗣️) | van der Schaaf, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7220022 | Development of an Innovative Food Product | | | van der Schaaf |
| ST 2025 | 7220022 | Development of an Innovative Food Product - presentation | | | van der Schaaf |

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

Competence Certificate

Success control is an examination of another kind: a written elaboration

Prerequisites


None





T

7.47 Course: Development of an Innovative Food Product - presentation [T-CIWVT-111010]

Responsible: Dr.-Ing. Ulrike van der Schaaf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104388 - Development of an Innovative Food Product](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------|---------|
| Examination of another type | 3 | Grade to a third | Each term | 1 |

| Events | | | | | |
|----------|---------|---|-------|--|-----------------------------------|
| ST 2025 | 2211220 | Team Project "Eco TROPHELIA": Development of an Innovative Food Product | 3 SWS | Project (P / ) | van der Schaaf, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7220025 | Development of an Innovative Food Product | | | van der Schaaf |
| ST 2025 | 7220025 | Development of an Innovative Food Product | | | van der Schaaf |

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

Competence Certificate

Success control is an examination of another kind: Seminar/ Presentation.


Prerequisites





None

T**7.48 Course: Digital Design in Process Engineering - Laboratory [T-CIWVT-111582]**

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105782 - Digital Design in Process Engineering](#)

| Type | Credits | Grading scale | Version |
|----------------------------------|---------|---------------|---------|
| Completed coursework (practical) | 3 | pass/fail | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|-----------------|
| WT 24/25 | 2241031 | Practical Course Digital Design in Process Engineering | 2 SWS | Practical course /  | Klahn, Jayavelu |
| Exams | | | | | |
| WT 24/25 | 7293100 | Digital Design in Process Engineering - Laboratory | | | Klahn |

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

Competence Certificate

Laboratory, ungraded.

Prerequisites

None.

T

7.49 Course: Digital Design in Process Engineering - Oral Examination [T-CIWVT-111583]


Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105782 - Digital Design in Process Engineering](#)





Type
Oral examination

Credits
3

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|-------|
| WT 24/25 | 2241030 | Digital Design in Process Engineering | 2 SWS | Lecture /  | Klahn |
| Exams | | | | | |
| WT 24/25 | 7293101 | Digital Design in Process Engineering - Oral Examination | | | Klahn |
| ST 2025 | 7293101 | Digital Design in Process Engineering - Oral Examination | | | Klahn |

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

Competence Certificate

Learning control is an oral examination with a duration of about 30 minutes according to SPO section 4, subsection 2 No. 2.

Prerequisites

Participation in the laboratory.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-111582 - Digital Design in Process Engineering - Laboratory](#) must have been passed.

T

7.50 Course: Digitization in Particle Technology [T-CIWVT-110111]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104973 - Digitization in Particle Technology](#)


Type
Oral examination

Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|--------------------------|
| WT 24/25 | 2245220 | Digitization in Particle Technology | 2 SWS | Lecture /  | Gleiß, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7291922 | Digitization in Particle Technology | | | Gleiß |
| ST 2025 | 7291922 | Digitization in particle technology | | | Gleiß |

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

Competence Certificate


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





Prerequisites

None

T

7.51 Course: Dimensional Analysis of Fluid Mechanics Problems [T-CIWVT-108882]**Responsible:** Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104327 - Dimensional Analysis of Fluid Mechanics Problems](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|--|-------|---|-----------|
| ST 2025 | 2242230 | Dimensional Analysis of Fluid Mechanics Problems | 2 SWS | Lecture /  | Hochstein |
| Exams | | | | | |
| WT 24/25 | 7290201 | Dimensional Analysis of Fluid Mechanics Problems | | | Hochstein |
| ST 2025 | 7290201 | Dimensional Analysis of Fluid Mechanics Problems | | | Hochstein |

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

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.52 Course: Drying Technology [T-CIWVT-108936]

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104370 - Drying Technology](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--------------|----------------------------|
| WT 24/25 | 2260210 | Drying Technology | 2 SWS | Lecture / ✕ | Schabel |
| WT 24/25 | 2260211 | Exercises for 2260210 Drying Technology | 1 SWS | Practice / ✕ | Schabel, und Mitarbeitende |
| ST 2025 | 2260210 | Drying Technology | 2 SWS | Lecture / 🎧 | Schabel |
| ST 2025 | 2260211 | Exercises for 2260210 Drying Technology | 1 SWS | Practice / 🎧 | Schabel, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7280022 | Drying Technology | | | |
| ST 2025 | 7260210 | Drying Technology | | | |

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

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.53 Course: Dynamics of Process Engineering Systems - Exam [T-CIWVT-114106]

Responsible: Dr.-Ing. Pascal Jerono

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-107037 - Dynamics of Process Engineering Systems](#)



Type
Oral examination





Credits
3

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|---------|---------|---|-------|--|--------|
| ST 2025 | 2243120 | Dynamics of Process Engineering Systems | 2 SWS | Lecture /  | Jerono |
| ST 2025 | 2243121 | Dynamics of Process Engineering Systems - Exercises | 1 SWS | Practice /  | Jerono |

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

Competence Certificate

Learning control is an oral exam lasting approx. 45 minutes.



Prerequisites





The written elaboration is a prerequisite for the oral exam

[T-CIWVT-114105 - Dynamics Process Engineering Systems - Prerequisite](#)

T**7.54 Course: Dynamics Process Engineering Systems - Prerequisite [T-CIWVT-114105]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-107037 - Dynamics of Process Engineering Systems](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 3 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|---------|---------|---|-------|--|--------|
| ST 2025 | 2243120 | Dynamics of Process Engineering Systems | 2 SWS | Lecture /  | Jerono |
| ST 2025 | 2243121 | Dynamics of Process Engineering Systems - Exercises | 1 SWS | Practice /  | Jerono |

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

Learning control is an examination of another type:

Written elaboration on a task that is handed out in the lecture.

Prerequisites

None

T

7.55 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration [T-FORUM-113580]**Responsible:** Dr. Christine Mielke
Christine Myglas**Organisation:** General Studies. Forum Science and Society (FORUM)**Part of:** [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------|---------|
| Examination of another type | 3 | Grade to a third | Each term | 1 |

Competence Certificate

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

Prerequisites

None

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

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

Recommendation

The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.

The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation

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

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

T**7.56 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration [T-FORUM-113582]****Responsible:** Dr. Christine Mielke
Christine Myglas**Organisation:** General Studies. Forum Science and Society (FORUM)**Part of:** [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------|---------|
| Examination of another type | 3 | Grade to a third | Each term | 1 |

Competence Certificate

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

Prerequisites

None

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

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

Recommendation

The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.

The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation

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

T**7.57 Course: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration [T-FORUM-113581]****Responsible:** Dr. Christine Mielke
Christine Myglas**Organisation:** General Studies. Forum Science and Society (FORUM)**Part of:** [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------|---------|
| Examination of another type | 3 | Grade to a third | Each term | 1 |

Competence Certificate

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

Prerequisites

None

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

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

Recommendation

The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.

The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Annotation

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

T

7.58 Course: Electrobiotechnology [T-CIWVT-113148]



Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106518 - Electrobiotechnology](#)





Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
2

| Events | | | | | |
|----------|----------------|--|----------|---|----------|
| WT 24/25 | 2212010 | Electrobiotechnology | 2 SWS | Lecture /  | Holtmann |
| WT 24/25 | 2212011 | Electrobiotechnology - Exercises | 1 SWS | Seminar /  | Holtmann |
| Exams | | | | | |
| WT 24/25 | 7212010-VT-EBT | Electrobiotechnology | Holtmann | | |
| ST 2025 | 7212010-VT-EBT | Electrobiotechnology | Holtmann | | |

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

Modeled Conditions

You have to fulfill one of 2 conditions:

1. The course T-CIWVT-113140 - Electrobiotechnology Seminar must have been passed.
2. The course [T-CIWVT-113829 - Electrobiotechnology Seminar](#) must have been passed.

T

7.59 Course: Electrobiotechnology Seminar [T-CIWVT-113829]


Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106518 - Electrobiotechnology](#)





Type
Examination of another type

Credits
2

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------------|--|-------|---|----------|
| WT 24/25 | 2212011 | Electrobiotechnology - Exercises | 1 SWS | Seminar /  | Holtmann |
| Exams | | | | | |
| WT 24/25 | 7212011-S-EBT | Electrobiotechnology Seminar | | | Holtmann |

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



7.60 Course: Electrocatalysis [T-ETIT-111831]

Responsible: Dr. Philipp Röse

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: [M-ETIT-105883 - Electrocatalysis](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 6 | Grade to a third | Each summer term | 2 |

| Events | | | | | |
|---------|---------|--|-------|------------|------|
| ST 2025 | 2304300 | Electrocatalysis | 3 SWS | Lecture / | Röse |
| ST 2025 | 2304301 | Exercise to 2304300 Electrocatalysis | 1 SWS | Practice / | Röse |
| Exams | | | | | |
| ST 2025 | 7300021 | Electrocatalysis | | | Röse |

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

Competence Certificate

The examination takes place in form of a written examination lasting 120 minutes.



7.61 Course: Electrochemistry [T-CHEMBIO-109773]

Organisation: KIT Department of Chemistry and Biosciences

Part of: [M-CHEMBIO-106697 - Electrochemistry](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------|---------|
| Written examination | 3 | Grade to a third | Irregular | 1 |

| Exams | | | |
|---------|-------------|----------------------------------|-------------------------------|
| ST 2025 | 7100101EC | Electrochemistry | Schuster, Nattland, Passerini |
| ST 2025 | 7100101EC_2 | Electrochemistry | Schuster, Nattland |

Prerequisites

none

T

7.62 Course: Energy from Biomass [T-CIWVT-108828]

Responsible: Dr.-Ing. Siegfried Bajohr
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104288 - Biomass Based Energy Carriers](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|---------------------------|
| WT 24/25 | 2231510 | Biomass Based Energy Carriers | 2 SWS | Lecture /  | Bajohr |
| WT 24/25 | 2231511 | Exercises on 2231510 Biomass Based Energy Carriers | 1 SWS | Practice /  | Bajohr, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7230016 | Energy from Biomass | | | Bajohr |
| ST 2025 | 7230016 | Energy from Biomass | | | Bajohr |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.63 Course: Energy Technology [T-CIWVT-108833]

Responsible: Prof. Dr.-Ing. Horst Büchner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104293 - Energy Technology](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|-------------------------------------|-------|---|---------|
| WT 24/25 | 2232810 | Energy Technology I | 2 SWS | Lecture /  | Büchner |
| Exams | | | | | |
| WT 24/25 | 7231501 | Energy Technology | | | Büchner |
| ST 2025 | 7231501 | Energy Technology | | | Büchner |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.64 Course: Engineering Heterogeneous Catalysis [T-CIWVT-114085]

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107025 - Engineering Heterogeneous Catalysis](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|---------|---------|---|----------|--|----------|
| ST 2025 | 2220040 | Engineering Heterogeneous Catalysis | 2 SWS | Lecture /  | Wehinger |
| ST 2025 | 2220041 | Engineering Heterogeneous Catalysis - Exercises | 1 SWS | Practice /  | Wehinger |
| Exams | | | | | |
| ST 2025 | 7220040 | Heterogeneous Catalysis for Engineers | Wehinger | | |

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

Competence Certificate

Learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

T

7.65 Course: Entrepreneurship [T-WIWI-102864]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)



Type
Written examination





Credits
3

Grading scale
Grade to a third

Recurrence
Each term

Version
1

| Events | | | | | |
|----------|---------|----------------------------------|-------|---|----------------|
| WT 24/25 | 2545001 | Entrepreneurship | 2 SWS | Lecture /  | Terzidis, Dang |
| ST 2025 | 2545001 | Entrepreneurship | 2 SWS | Lecture /  | Terzidis, Dang |
| Exams | | | | | |
| WT 24/25 | 7900045 | Entrepreneurship | | | Terzidis |
| WT 24/25 | 7900229 | Entrepreneurship | | | Terzidis |
| ST 2025 | 7900002 | Entrepreneurship | | | Terzidis |
| ST 2025 | 7900192 | Entrepreneurship | | | Terzidis |

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

T

7.66 Course: Environmental Biotechnology [T-CIWVT-106835]

Responsible: Andreas Tiehm
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104320 - Environmental Biotechnology](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

| Events | | | | | |
|----------|---------|---|-------|---|-------|
| WT 24/25 | 2233810 | Environmental Biotechnology | 2 SWS | Lecture /  | Tiehm |
| Exams | | | | | |
| WT 24/25 | 7232614 | Environmental Biotechnology | Tiehm | | |
| ST 2025 | 7232614 | Environmental Biotechnology | Tiehm | | |

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

Prerequisites

None

T

7.67 Course: Estimator and Observer Design [T-CIWVT-112828]

Responsible: Dr.-Ing. Pascal Jerono
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106320 - Estimator and Observer Design](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|---|-------|------------------------------|--------|
| WT 24/25 | 2243110 | Estimator and Observer Design | 3 SWS | Lecture / Practice (/ ●) | Jerono |
| Exams | | | | | |
| WT 24/25 | 7200007 | Estimator and Observer Design | | | Jerono |
| ST 2025 | 7243110 | Estimator and Observer Design | | | Jerono |

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

T


7.68 Course: Exercises: Membrane Technologies [T-CIWVT-113235]





Responsible: Prof. Dr. Harald Horn
Dr.-Ing. Florencia Saravia

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-105380 - Membrane Technologies in Water Treatment](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------|---------|---------------|------------------|---------|
| Completed coursework | 1 | pass/fail | Each summer term | 1 |

| Events | | | | | |
|---------|---------|--|-------|--|----------------------------------|
| ST 2025 | 2233011 | Membrane Technologies in Water Treatment - Exercises | 1 SWS | Practice /  | Horn, Saravia, und Mitarbeitende |
| Exams | | | | | |
| ST 2025 | 7233011 | Exercises for Membrane Technologies | | | Horn, Saravia |

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

Competence Certificate

Learning control is a completed coursework: Submission of exercises, membrane design and short presentation (5 minutes, group work).

T

7.69 Course: Excursions: Water Supply [T-CIWVT-110866]


Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103440 - Practical Course in Water Technology](#)





| Type | Credits | Grading scale | Recurrence | Version |
|----------------------|---------|---------------|------------------|---------|
| Completed coursework | 1 | pass/fail | Each winter term | 1 |

| Exams | | | |
|----------|---------|--|---------------------|
| WT 24/25 | 7232006 | Excursions: Water Supply | Horn, Hille-Reichel |

T

7.70 Course: Extrusion Technology in Food Processing [T-CIWVT-112174]**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-105996 - Extrusion Technology in Food Processing](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|------|
| WT 24/25 | 2211310 | Extrusion Technology in Food Processing | 2 SWS | Lecture /  | Emin |
| Exams | | | | | |
| WT 24/25 | 7200062 | Extrusion Technology in Food Processing | | | Emin |
| ST 2025 | 7211310 | Extrusion Technology in Food Processing | | | Emin |

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

Learning control is an oral exam lasting about 20 minutes.

Prerequisites

None.

T

7.71 Course: Flow and Combustion Instabilities in Technical Burner Systems [T-CIWVT-108834]

Responsible: Prof. Dr.-Ing. Horst Büchner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104294 - Flow and Combustion Instabilities in Technical Burner Systems](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|---------|
| ST 2025 | 2232820 | Flow and Combustion Instabilities in Technical Burner Systems | 2 SWS | /  | Büchner |
| Exams | | | | | |
| WT 24/25 | 7231502 | Flow and Combustion Instabilities in Technical Burner Systems | | | Büchner |
| ST 2025 | 7231502 | Flow and Combustion Instabilities in Technical Burner Systems | | | Büchner |

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

Competence Certificate



The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.72 Course: Fluid Mechanics of Non-Newtonian Fluids [T-CIWVT-108874]**Responsible:** Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104322 - Fluid Mechanics of Non Newtonian Fluids](#)**Type**
Oral examination**Credits**
8**Grading scale**
Grade to a third**Recurrence**
Each term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|-----------|
| WT 24/25 | 2242250 | Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids | 2 SWS | Lecture /  | Hochstein |
| ST 2025 | 2242230 | Dimensional Analysis of Fluid Mechanic Problems | 2 SWS | Lecture /  | Hochstein |
| Exams | | | | | |
| WT 24/25 | 7290204 | Fluid Mechanics of Non-Newtonian Fluids | | | Hochstein |
| ST 2025 | 7290204 | Fluid Mechanics of Non-Newtonian Fluids | | | Hochstein |

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

T

7.73 Course: Fluidized Bed Technology [T-CIWVT-108832]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104292 - Fluidized Bed Technology](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|-------|
| ST 2025 | 2231110 | Fluidized Bed Technology | 2 SWS | Lecture /  | Rauch |
| Exams | | | | | |
| WT 24/25 | 7230012 | Fluidized Bed Technology | | | Rauch |
| ST 2025 | 7230012 | Fluidized Bed Technology | | | Rauch |

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

T

7.74 Course: Food Chemistry Basics [T-CHEMBIO-109442]

Responsible: Prof. Dr. Mirko Bunzel
Organisation: KIT Department of Chemistry and Biosciences
Part of: [M-CHEMBIO-104620 - Food Chemistry Basics](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
2

| Events | | | | | |
|----------|----------|---|-------|---|--------|
| ST 2025 | 6601 | Grundlagen der Lebensmittelchemie I | 2 SWS | Lecture /  | Bunzel |
| Exams | | | | | |
| WT 24/25 | 71109442 | Food Chemistry Basics | | | Bunzel |
| ST 2025 | 71109442 | Food Chemistry Basics | | | Bunzel |


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





Prerequisites

None

T

7.75 Course: Formulation of (Bio)pharmaceutical Therapeutics [T-CIWVT-108805]**Responsible:** Prof. Dr. Jürgen Hubbuch**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104266 - Formulation of \(Bio\)pharmaceutical Therapeutics](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|---------|
| WT 24/25 | 2214030 | Formulation of (Bio)pharmaceutical Therapeutics | 2 SWS | Lecture /  | Hubbuch |
| Exams | | | | | |
| WT 24/25 | 7223012 | Formulation of (Bio)pharmaceutical Therapeutics | | | Hubbuch |
| ST 2025 | 7223012 | Formulation of (Bio)pharmaceutical Therapeutics | | | Hubbuch |

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

The examination is an oral examination with a duration of about 15 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.76 Course: Fuel Technology [T-CIWVT-108829]

Responsible: Dr. Frederik Scheiff
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104289 - Fuel Technology](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|----------------------------|
| WT 24/25 | 2231020 | Fuel Technology | 2 SWS | Lecture /  | Scheiff |
| WT 24/25 | 2231021 | Exercises on 2231020 Fuel Technology | 1 SWS | Practice /  | Scheiff, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7230013 | Fuel Technology | | | Scheiff, Kolb |
| ST 2025 | 7230013 | Fuel Technology | | | Kolb, Scheiff |

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

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.77 Course: Fundamentals of Water Quality [T-CIWVT-106838]

Responsible: Dr. Michael Wagner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103438 - Fundamentals of Water Quality](#)



Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

| Events | | | | | |
|----------|---------|---|--------|--|---------------------------|
| WT 24/25 | 2233230 | Fundamentals of Water Quality | 2 SWS | Lecture /  | Wagner |
| WT 24/25 | 2233231 | Fundamentals of Water Quality - Exercises | 1 SWS | Practice /  | Wagner, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232625 | Fundamentals of Water Quality | Wagner | | |

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

Competence Certificate



Learning control ist an oral exam lasting approx. 20 minutes.





Prerequisites

None.

T

7.78 Course: Gas Particle Measurement Technology [T-CIWVT-108892]**Responsible:** Prof. Dr.-Ing. Achim Dittler**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104337 - Gas Particle Measurement Technology](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|--|-------|--|----------------------------|
| WT 24/25 | 2244020 | Gas Particle Measurement Technology | 2 SWS | Lecture /  | Dittler |
| WT 24/25 | 2244021 | Exercises on 2244020 Gas Particle Measurement Technology | 1 SWS | Practice /  | Dittler, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7244020 | Gas Particle Measurement Technology | | | Dittler |
| ST 2025 | 7244020 | Gas Particle Measurement Technology | | | Dittler |

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

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.79 Course: Gas Particle Separation Processes [T-CIWVT-108895]

Responsible: Dr.-Ing. Jörg Meyer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104340 - Gas Particle Separation Processes](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|-------|
| WT 24/25 | 2244120 | Gas Particle Separation Processes | 2 SWS | Lecture /  | Meyer |
| WT 24/25 | 2244121 | Exercises on 2244120 Gas Particle Separation Processes | 1 SWS | Practice /  | Meyer |
| Exams | | | | | |
| WT 24/25 | 7244120 | Gas Particle Separation Processes | | | Meyer |
| ST 2025 | 7244120 | Gas Particle Separation Processes | | | Meyer |

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

Competence Certificate

The examination is an oral examination with a duration of about 30 minutes (single examination) or 20 minutes (comprehensive examination in VF Gas-Partikel-Systeme) (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.80 Course: Heat Exchangers [T-CIWVT-108937]

Responsible: Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104371 - Heat Exchangers](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---------------------------------|-------|---|--------|
| WT 24/25 | 2260010 | Heat Exchangers | 2 SWS | Lecture /  | Wetzel |
| Exams | | | | | |
| WT 24/25 | 7280032 | Heat Exchangers | | | Wetzel |
| ST 2025 | 7260010 | Heat Exchangers | | | Wetzel |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.81 Course: Heat Transfer II [T-CIWVT-106067]



Responsible: Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103051 - Heat Transfer II](#)





Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
3



| Events | | | | | |
|----------|---------|---|-------|--|------------------|
| WT 24/25 | 2260020 | Heat Transfer II | 2 SWS | Lecture /  | Wetzel, Dietrich |
| WT 24/25 | 2260021 | Exercises on 2260020 Heat Transfer II | 1 SWS | Practice /  | Wetzel, Dietrich |
| Exams | | | | | |
| WT 24/25 | 7280031 | Heat Transfer II | | | Wetzel, Dietrich |
| ST 2025 | 7260020 | Heat Transfer II | | | Wetzel, Dietrich |



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

T

7.82 Course: High Temperature Process Engineering [T-CIWVT-106109]

Responsible: Prof. Dr.-Ing. Dieter Stapf**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-103075 - High Temperature Process Engineering](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|--|-------|--|--------------------------|
| ST 2025 | 2232210 | High Temperature Process Engineering | 2 SWS | Lecture /  | Stapf |
| ST 2025 | 2232211 | High Temperature Process Engineering - Exercises | 1 SWS | Practice /  | Stapf, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7231001 | High Temperature Process Engineering | Stapf | | |
| ST 2025 | 7231001 | High Temperature Process Engineering | Stapf | | |

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

None

T

7.83 Course: Hydrogen and Fuel Cell Technologies [T-CIWVT-108836]

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104296 - Hydrogen and Fuel Cell Technologies](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|-----------|---|-------|---|--------|
| ST 2025 | 2232030 | Hydrogen and Fuel Cell Technologies | 2 SWS | Lecture /  | Trimis |
| Exams | | | | | |
| WT 24/25 | 7231204 | Hydrogen and Fuel Cell Technologies | | | Trimis |
| WT 24/25 | 7231204-2 | Hydrogen and Fuel Cell Technologies | | | Trimis |
| ST 2025 | 7231204 | Hydrogen and Fuel Cell Technologies | | | Trimis |

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

Prerequisites

None

T

7.84 Course: Hydrogen in Materials – Exercises and Lab Course [T-MACH-112159]**Responsible:** Dr. rer. nat. Stefan Wagner**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-107278 - Hydrogen in Materials – Exercises and Lab Course](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|----------------------|---------|---------------|------------------|-----------|---------|
| Completed coursework | 4 | pass/fail | Each summer term | 1 terms | 2 |

| Events | | | | | |
|----------|------------------|--|-------|--------------|--------|
| WT 24/25 | 2173584 | Hydrogen in Materials – Exercises and Lab Course | 2 SWS | Practice / ✕ | Wagner |
| ST 2025 | 2173584 | Hydrogen in Materials – Exercises and Lab Course | 2 SWS | Practice / ● | Wagner |
| Exams | | | | | |
| ST 2025 | 76-T-MACH-112159 | Hydrogen in Materials – Exercises and Lab Course | | | Wagner |

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

Competence Certificate

Regular participation and participating in lab course, protocol included.

Prerequisites

none

Recommendation

Participation is only possible parallel to the lecture.


Workload





120 hours

T

7.85 Course: Hydrogen in Materials – Exercises and Lab Course [T-MACH-112942]**Responsible:** Dr. rer. nat. Stefan Wagner**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-107278 - Hydrogen in Materials – Exercises and Lab Course](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|----------------------|---------|---------------|------------------|-----------|---------|
| Completed coursework | 4 | pass/fail | Each winter term | 1 terms | 1 |

| Events | | | | | |
|----------|------------------|--|-------|--|--------|
| WT 24/25 | 2174573 | Hydrogen in Materials – Exercises and Lab Course | 2 SWS | Practice /  | Wagner |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-112942 | Hydrogen in Materials – Exercises and Lab Course | | | Wagner |
| ST 2025 | 76-T-MACH-112942 | Hydrogen in Materials – Exercises and Lab Course | | | Wagner |

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

Regular participation and participating in lab course, protocol included.

Prerequisites

none

Recommendation


Participation is only possible parallel to the lecture.

Workload

120 hours

T

7.86 Course: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [T-MACH-110957]**Responsible:** Prof. Dr. Astrid Pundt**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-107277 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
2

| Events | | | | | |
|----------|------------------|--|-------|---|---------------|
| WT 24/25 | 2174572 | Hydrogen in Materials: from energy storage to hydrogen embrittlement | 2 SWS | Lecture /  | Pundt, Wagner |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-110957 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | | | Pundt |
| ST 2025 | 76-T-MACH-110957 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | | | Pundt |

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

Oral exam, about 25 minutes

Prerequisites

T-MACH-110923 - Wasserstoff in Materialien: von der Energiespeicherung zur Materialversprödung has not been started

T-MACH-108853 - Wasserstoff in Materialien has not been started

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-MACH-110923 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement](#) must not have been started.

Annotation

in German

Workload

120 hours

T

7.87 Course: Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement [T-MACH-110923]**Responsible:** Prof. Dr. Astrid Pundt**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-107277 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
2

| Events | | | | | |
|----------|------------------|--|-------|-------------|---------------|
| WT 24/25 | 2173588 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | 2 SWS | Lecture / ✕ | Pundt, Wagner |
| ST 2025 | 2173588 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | 2 SWS | Lecture / 🎧 | Pundt, Wagner |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-110923 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | | | Pundt |
| ST 2025 | 76-T-MACH-110923 | Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement | | | Pundt |

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

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

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-MACH-110957 - Hydrogen in Materials: from Energy Storage to Hydrogen Embrittlement](#) must not have been started.

Annotation

in English

Workload

120 hours

T

7.88 Course: Industrial Aspects in Bioprocess Technology [T-CIWVT-110935]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105412 - Industrial Aspects in Bioprocess Technology](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|---------|
| ST 2025 | 2214020 | Industrial Aspects in Bioprocess Technology | 2 SWS | Lecture /  | Hubbuch |
| Exams | | | | | |
| WT 24/25 | 7223016 | Industrial Aspects in Bioprocess Technology | | | Hubbuch |
| ST 2025 | 7223016 | Industrial Aspects in Bioprocess Technology | | | Hubbuch |

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

Competence Certificate

The examination is an oral examination with a duration of about 15 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.89 Course: Industrial Biocatalysis [T-CIWVT-113432]

Responsible: PD Dr. Jens Rudat
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106678 - Industrial Biocatalysis](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|----------------|---|-------|---|-------|
| ST 2025 | 2212230 | Industrial Biocatalysis | 2 SWS | Lecture /  | Rudat |
| Exams | | | | | |
| WT 24/25 | 7212230_VT-IBK | Industrial Biocatalysis | | | Rudat |
| ST 2025 | 7212230-VT-IBK | Industrial Biocatalysis | | | Rudat |

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

Competence Certificate

The learning control is an oral exam lasting approx. 20 minutes.

Prerequisites

None

T

7.90 Course: Industrial Bioprocesses [T-CIWVT-113120]

Responsible: Prof. Dr.-Ing. Michael-Helmut Kopf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106501 - Industrial Bioprocesses](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|------|
| WT 24/25 | 2245810 | Industrial Bioprocesses | 2 SWS | Lecture /  | Kopf |
| Exams | | | | | |
| WT 24/25 | 7245810 | Industrial bioprocesses | Kopf | | |
| ST 2025 | 7291933 | Industrial bioprocesses | Kopf | | |

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

Competence Certificate

Learning control is an oral examination with a duration of about 25 minutes.

Prerequisites


None





T

7.91 Course: Industrial Wastewater Treatment [T-CIWVT-111861]

Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105903 - Industrial Wastewater Treatment](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|------------------|---------|------------------|------------------|-----------|---------|
| Oral examination | 4 | Grade to a third | Each summer term | 1 terms | 1 |

| Events | | | | | |
|----------|---------|---|-------|---|------|
| ST 2025 | 2233020 | Industrial Wastewater Treatment | 2 SWS | Lecture /  | Horn |
| Exams | | | | | |
| WT 24/25 | 7232007 | Industrial Wastewater Treatment | | | Horn |
| ST 2025 | 7232007 | Industrial Wastewater Treatment | | | Horn |

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

Competence Certificate

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites



None





T

7.92 Course: Initial Exam Process Technology and Plant Design [T-CIWVT-106149]

Responsible: Dr. Frederik Scheiff
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104374 - Process Technology](#)

| Type | Credits | Grading scale | Recurrence | Version |
|--------------------------------|---------|---------------|------------------|---------|
| Completed coursework (written) | 0 | pass/fail | Each winter term | 1 |

| Events | | | | | |
|----------|-----------|--|-------|--|----------------------------|
| WT 24/25 | 2231010 | Process Technology and Plant Design I | 2 SWS | Lecture /  | Scheiff, Bajohr |
| WT 24/25 | 2231012 | Practical Course Process Technology and Plant Design | 1 SWS | Practical course /  | Scheiff, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7230100 | | | | Scheiff |
| WT 24/25 | 7230100-2 | Initial Exam Process Technology and Plant Design | | | Scheiff |

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

Competence Certificate

Completed coursework; ungraded exam

Prerequisites

None

T



7.93 Course: Innovation Management for Products & Processes in the Chemical Industry [T-CIWVT-108980]





Responsible: Dr. Claudius Neumann

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104397 - Innovation Management for Products & Processes in the Chemical Industry](#)

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

| Events | | | | | |
|----------|---------|--|---------|---|----------------|
| WT 24/25 | 2231330 | Innovation Management for Products and Processes in the Chemical Industry - Announcement | 2 SWS | Block /  | Sauer, Neumann |
| ST 2025 | 2231330 | Innovation Management for Products and Processes in the Chemical Industry | 2 SWS | Block /  | Sauer, Neumann |
| Exams | | | | | |
| WT 24/25 | 7200028 | Innovation Management for Products & Processes in the Chemical Industry | Neumann | | |
| ST 2025 | 7231330 | Innovation Management for Products & Processes in the Chemical Industry | Neumann | | |

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

Competence Certificate

The examination is a written examination (multiple choice) with a duration of 30 minutes (section 4 subsection 2 number 1 SPO).


Prerequisites





None

T**7.94 Course: Innovation Project Electronic Devices from Printable Conductive Materials [T-CIWVT-113226]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)

| Type | Credits | Grading scale | Version |
|-----------------------------|---------|------------------|---------|
| Examination of another type | 6 | Grade to a third | 1 |

| Events | | | | | |
|----------|---------|---|-------|--|--------------|
| WT 24/25 | 2242062 | Innovation Project Electronic Devices from Printable Conductive Materials | 2 SWS | Project (P / ) | Willenbacher |

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

Competence Certificate

Learning control is an examination of another type.

Prerequisites


The innovation project can only be chosen in combination with one of the following modules:





- Innovative Concepts for Formulation and Processing of Printable Materials
- Stability of Disperse Systems

T**7.95 Course: Innovation Project Porous Ceramics from the 3D Printer [T-CIWVT-112201]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)

| Type | Credits | Grading scale | Version |
|-----------------------------|---------|------------------|---------|
| Examination of another type | 6 | Grade to a third | 1 |

| Events | | | | | |
|----------|---------|--|-------|--|--------------|
| WT 24/25 | 2242061 | Innovation Project Porous Ceramics from the 3D Printer | 2 SWS | Project (P / ) | Willenbacher |
| Exams | | | | | |
| ST 2025 | 7242061 | Innovation Project Porous Ceramics from the 3D Printer | | | Willenbacher |

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


Prerequisites




None.

T

7.96 Course: Innovative Concepts for Formulation and Processing of Printable Materials [T-CIWVT-112170]**Responsible:** Prof. Dr. Norbert Willenbacher**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-105993 - Innovative Concepts for Formulation and Processing of Printable Materials](#)

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

| Events | | | | | |
|----------|---------|---|-------|---|--------------|
| WT 24/25 | 2242060 | Innovative Concepts for Formulation and Processing of Printable Materials | 2 SWS | Lecture /  | Willenbacher |
| Exams | | | | | |
| WT 24/25 | 7290108 | Innovative Concepts for Formulation and Processing of Printable Materials | | | Willenbacher |

Legend:  Online,  Blended (On-Site/Online),  On-Site, X Cancelled**Competence Certificate**

The learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None

Workload

120 hours

T

7.97 Course: Internship [T-CIWVT-109276]

Responsible: Dr.-Ing. Siegfried Bajohr
Dr.-Ing. Barbara Freudig

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104527 - Internship](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------|---------|
| Completed coursework (practical) | 14 | pass/fail | Each term | 1 |

| Exams | | | |
|----------|---------|----------------------------|--------|
| WT 24/25 | 7200000 | Internship | Bajohr |
| ST 2025 | 7200000 | Internship | Bajohr |

Prerequisites

None

T

7.98 Course: Introduction to Numerical Simulation of Reacting Flows [T-CIWVT-113436]

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106676 - Introduction to Numerical Simulation of Reacting Flows](#)

| Type | Credits | Grading scale | Version |
|------------------|---------|------------------|---------|
| Oral examination | 3 | Grade to a third | 2 |

| Events | | | | | |
|----------|-----------|--|-------|--------------|-------|
| WT 24/25 | 2232130 | Introduction to Numerical Simulation of Reacting Flows | 2 SWS | Lecture / 🎧 | Stein |
| WT 24/25 | 2232131 | Introduction to Numerical Simulation of Reacting Flows - Exercises | 2 SWS | Practice / 🎧 | Stein |
| Exams | | | | | |
| WT 24/25 | 722232130 | Introduction to Numerical Simulation of Reacting Flows | | | Stein |

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

Competence Certificate

The learning control ist an oral examination lasting approx. 30 minutes.

Prerequisites

The prerequisite must be passed before taking the oral examination.

Modeled Conditions

The following conditions have to be fulfilled:



1. The course [T-CIWVT-113435 - Introduction to Numerical Simulation of Reacting Flows - Prerequisite](#) must have been passed.





T

7.99 Course: Introduction to Numerical Simulation of Reacting Flows - Prerequisite [T-CIWVT-113435]

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106676 - Introduction to Numerical Simulation of Reacting Flows](#)

| Type | Credits | Grading scale | Version |
|----------------------|---------|---------------|---------|
| Completed coursework | 5 | pass/fail | 2 |

| Events | | | | | |
|----------|---------|---|-------|--|-------|
| WT 24/25 | 2232130 | Introduction to Numerical Simulation of Reacting Flows | 2 SWS | Lecture /  | Stein |
| WT 24/25 | 2232131 | Introduction to Numerical Simulation of Reacting Flows - Exercises | 2 SWS | Practice /  | Stein |
| Exams | | | | | |
| WT 24/25 | 7232131 | Introduction to Numerical Simulation of Reacting Flows - Prerequisite | | | Stein |

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

Competence Certificate

The learning control is a completed coursework: Reports on the tutorials documenting the processed task, the data generated and their analysis.


Prerequisites





None

T

7.100 Course: Introduction to Sensory Analysis with Practice [T-CIWVT-109128]**Responsible:** Dr. Heike Hofsäß**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-105933 - Introduction to Sensory Analysis](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 2 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 6630 | Einführung in die Sensorik mit Übungen | 1 SWS | Lecture /  | Hofsäß |
| Exams | | | | | |
| WT 24/25 | 7220016 | Introduction to Sensory Analysis with Practice | | | Bunzel |
| ST 2025 | 7220016 | Introduction to Sensory Analysis with Practice | | | Scherf |


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





None

T

7.101 Course: Journal Club - Novel Bioproduction Systems [T-CIWVT-113149]**Responsible:** Prof. Dr.-Ing. Dirk Holtmann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106526 - Journal Club - Novel Bioproduction Systems](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 4 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|---------|---------------|--|----------|---|----------|
| ST 2025 | 2212040 | Journal Club – Novel Bioproduction Systems | 2 SWS | Seminar /  | Holtmann |
| Exams | | | | | |
| ST 2025 | 7212040-VT-JC | Journal Club - Novel Bioproduction Systems | Holtmann | | |

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

None.

T

7.102 Course: Kinetics and Catalysis [T-CIWVT-106032]

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104383 - Kinetics and Catalysis](#)



Type
Written examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|-----------------------------|
| ST 2025 | 2220030 | Kinetics and Catalysis | 2 SWS | Lecture /  | Wehinger |
| ST 2025 | 2220031 | Kinetics and Catalysis - Exercises | 1 SWS | Practice /  | Wehinger, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7210102 | Kinetics and Catalysis | | | Wehinger |
| ST 2025 | 7210102 | Kinetics and Catalysis | | | Wehinger |

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

Competence Certificate

Learning control is a written examination lasting 60 minutes.

Prerequisites



None





T

7.103 Course: Laboratory Work for NMR for Engineers [T-CIWVT-109144]

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104401 - NMR for Engineers](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------------|---------|
| Completed coursework (practical) | 2 | pass/fail | Each winter term | 1 |

| Events | | | | | |
|----------|---------|---|-------|---|-----------|
| WT 24/25 | 2245130 | NMR for Engineers | 2 SWS | Lecture /  | Guthausen |
| WT 24/25 | 2245131 | Laboratory Work for 2245130 NMR for Engineers | 2 SWS | Practical course /  | Guthausen |
| Exams | | | | | |
| WT 24/25 | 7291955 | Laboratory Work for NMR for Engineers | | | Guthausen |

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

Prerequisites

None

T

7.104 Course: Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113578]

Responsible: Dr. Christine Mielke
Christine Myglas

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

Part of: [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|----------------------|---------|---------------|------------------|-----------|---------|
| Completed coursework | 2 | pass/fail | Each summer term | 1 terms | 1 |

Competence Certificate

Active participation, learning protocols, if applicable.

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:

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

Recommendation

It is recommended that you complete the lecture series "Science in Society" before attending events in the advanced module and in parallel with attending the basic seminar.

If it is not possible to attend the lecture series and the basic seminar in the same semester, the lecture series can also be attended after attending the basic seminar.

However, attending events in the advanced module before attending the lecture series should be avoided.

Annotation

The basic module consists of the lecture series "Science in Society" and the basic seminar. The lecture series is only offered during the summer semester.

The basic seminar can be attended in the summer or winter semester.



7.105 Course: Liquid Transportation Fuels [T-CIWVT-111095]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105200 - Liquid Transportation Fuels](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|------------|-------|
| WT 24/25 | 2231130 | Liquid Transportation Fuels | 2 SWS | Lecture / | Rauch |
| WT 24/25 | 2231131 | Exercises on 2231130 Liquid Transportation Fuels | 1 SWS | Practice / | Rauch |
| Exams | | | | | |
| WT 24/25 | 7230010 | Liquid Transportation Fuels | | | Rauch |
| ST 2025 | 7230020 | Liquid Transportation Fuels | | | Rauch |

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

T

7.106 Course: Mass Transfer II [T-CIWVT-108935]

Responsible: Dr.-Ing. Benjamin Dietrich
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104369 - Mass Transfer II](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------------------|--|-----------------------------|
| WT 24/25 | 2260320 | Mass Transfer II | 2 SWS | Lecture /  | Dietrich |
| WT 24/25 | 2260321 | Exercises for 2260320 Mass Transfer II | 1 SWS | Practice /  | Dietrich, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7280021 | Mass Transfer II | Schabel, Dietrich | | |
| ST 2025 | 7260220 | Mass Transfer II | Schabel, Dietrich | | |

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

Competence Certificate

The examination is an oral examination with a duration of about 25 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.107 Course: Master's Thesis [T-CIWVT-109275]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104526 - Module Master's Thesis](#)

| Type | Credits | Grading scale | Recurrence | Version |
|--------------|---------|------------------|------------|---------|
| Final Thesis | 30 | Grade to a third | Each term | 2 |

Prerequisites

Process Technology and at least three further modules of the advanced fundamentals has to be passed. The internship has to be passed. The examination board decides on exceptions.


(Compare SPO section 14 subsection 1)





Final Thesis

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

Submission deadline 6 months
Maximum extension period 4 weeks
Correction period 8 weeks

T**7.108 Course: Materials and Processes for Electrochemical Storage [T-CIWVT-108146]****Responsible:** Prof. Dr. Jens Tübke**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104353 - Materials and Processes for Electrochemical Storage](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|-------|
| ST 2025 | 2245840 | Materials and Processes for Electrochemical Storage | 2 SWS | Lecture /  | Tübke |
| Exams | | | | | |
| WT 24/25 | 7291840 | Materials for Electrochemical Storage | | | Tübke |
| ST 2025 | 7245840 | Materials and Processes for Electrochemical Storage | | | Tübke |

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

None

T

7.109 Course: Measurement Techniques in Chemical Processing [T-CIWVT-109086]

Responsible: Dr.-Ing. Steffen Peter Müller

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104450 - Measurement Techniques in Chemical Processing \(including practical course\)](#)
[M-CIWVT-104490 - Measurement Techniques in Chemical Processing](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 2220330 | Measurement Techniques in Chemical Processing | 2 SWS | Lecture /  | Müller |
| ST 2025 | 2220331 | Measurement Techniques in Chemical Processing - Practical Course | 1 SWS | Practical course /  | Müller |
| Exams | | | | | |
| WT 24/25 | 7210107 | Measurement Techniques in Chemical Processing | | | Müller |
| ST 2025 | 7210107 | Measurement Techniques in Chemical Processing | | | Müller |

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



Competence Certificate





The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T**7.110 Course: Measurement Techniques in the Thermo-Fluid Dynamics [T-CIWVT-108837]****Responsible:** Prof. Dr.-Ing. Dimosthenis Trimis**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104297 - Measurement Techniques in the Thermo-Fluid Dynamics](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|--|--------|
| WT 24/25 | 2232040 | Diagnostics in Thermal Fluid Dynamics | 2 SWS | Lecture /  | Trimis |
| WT 24/25 | 2232041 | Exercises for 2232040 Diagnostics in Thermal Fluid Dynamics | 1 SWS | Practice /  | Trimis |
| Exams | | | | | |
| WT 24/25 | 7231202 | Measurement Techniques in the Thermo-Fluid Dynamics | | | Trimis |
| ST 2025 | 7231202 | Measurement Techniques in the Thermo-Fluid Dynamics | | | Trimis |

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

None

T**7.111 Course: Membrane Materials & Processes Research Masterclass [T-CIWVT-113153]****Responsible:** Prof. Dr. Andrea Schäfer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106529 - Membrane Materials & Processes Research Masterclass](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 6 | Grade to a third | Each winter term | 1 |

| Events | | | | | |
|----------|---------|---|-------|------------------------------|---------|
| WT 24/25 | 2233120 | Membrane Materials & Processes Research Masterclass | 4 SWS | Lecture / Practice (/ ●) | Schäfer |
| Exams | | | | | |
| WT 24/25 | 7233120 | Membrane Materials & Processes Research Masterclass | | | Schäfer |

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

Competence Certificate

Learning control is an examination of another type:

The exam will be composed of contributions during the course and an oral presentation during the full day workshop.

Prerequisites

None

T

7.112 Course: Membrane Technologies in Water Treatment [T-CIWVT-113236]

Responsible: Prof. Dr. Harald Horn
Dr.-Ing. Florencia Saravia

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-105380 - Membrane Technologies in Water Treatment](#)



Type
Written examination





Credits
5

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|----------------------------------|
| ST 2025 | 2233010 | Membrane Technologies in Water Treatment | 2 SWS | Lecture /  | Horn, Saravia |
| ST 2025 | 2233011 | Membrane Technologies in Water Treatment - Exercises | 1 SWS | Practice /  | Horn, Saravia, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232605 | Membrane Technologies in Water Treatment | | | Horn, Saravia |
| ST 2025 | 7233010 | Membrane Technologies in Water Treatment | | | Horn, Saravia |

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

Competence Certificate

Learning control is an written examination lasting 90 minutes.

Prerequisites

Prerequisite: Submission of exercises, membrane design and short presentation (5 minutes, group work).

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113235 - Exercises: Membrane Technologies](#) must have been passed.

T


7.113 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-102718 - Product Development – Methods of Product Engineering](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 6 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|----------|---------------------|---|-------|---|------------------|
| ST 2025 | 2146176 | Methods and Processes of PGE – Product Generation Engineering | 4 SWS | Lecture /  | Albers, Düser |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-105382 | Methods and Processes of PGE - Product Generation Engineering | | | Albers, Burkardt |
| WT 24/25 | 76-T-MACH-105382-en | Methods and Processes of PGE - Product Generation Engineering | | | Albers |
| ST 2025 | 76-T-MACH-105382 | Product Development - Methods of Product Development | | | Albers, Düser |
| ST 2025 | 76-T-MACH-105382-en | Methods and Processes of PGE - Product Generation Engineering | | | Albers, Düser |

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.

Workload

180 hours

T

7.114 Course: Microbiology for Engineers [T-CIWVT-106834]

Responsible: Prof. Dr. Thomas Schwartz
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104319 - Microbiology for Engineers](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|----------|
| ST 2025 | 2233840 | Microbiology for Engineers | 2 SWS | Lecture /  | Schwartz |
| Exams | | | | | |
| WT 24/25 | 7232633 | Microbiology for Engineers | | | Schwartz |
| ST 2025 | 7232633 | Microbiology for Engineers | | | Schwartz |

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

T

7.115 Course: Microfluidics [T-CIWVT-108909]

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104350 - Microfluidics](#)
[M-CIWVT-105205 - Microfluidics and Case Studies](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

| Events | | | | | |
|----------|---------|---|-------|---|----------|
| WT 24/25 | 2245410 | Microfluidics - Basics and Applications | 2 SWS | Lecture /  | Leneweit |
| Exams | | | | | |
| WT 24/25 | 7291410 | Microfluidics | | | Leneweit |
| ST 2025 | 7291410 | Microfluidics | | | Leneweit |

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

T**7.116 Course: Microfluidics - Case Studies [T-CIWVT-110549]**

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105205 - Microfluidics and Case Studies](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------|---------|---------------|------------------|---------|
| Completed coursework | 2 | pass/fail | Each winter term | 1 |

| Events | | | | | |
|----------|---------|---|-------|---|----------|
| WT 24/25 | 2245411 | Microfluidics - Basics and Applications with Lab Training | 1 SWS | Practical course /  | Leneweit |
| Exams | | | | | |
| WT 24/25 | 7291411 | Microfluidics - Case Studies | | | Leneweit |
| ST 2025 | 7291965 | Microfluidics - Case Studies | | | Leneweit |

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

Prerequisites

None

T

7.117 Course: Microrheology and High Frequency Rheology [T-CIWVT-108977]

Responsible: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104395 - Microrheology and High Frequency Rheology](#)


Type
Oral examination





Credits
2

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|--------------|
| ST 2025 | 2242110 | Microrheology and High Frequency Rheology | 1 SWS | Lecture /  | Oelschlaeger |
| Exams | | | | | |
| WT 24/25 | 7290301 | Microrheology and High Frequency Rheology | | | Oelschlaeger |
| ST 2025 | 7290301 | Microrheology and High Frequency Rheology | | | Oelschlaeger |

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

Prerequisites

None

T

7.118 Course: Mixing, Stirring, Agglomeration [T-CIWVT-110895]

Responsible: Dr.-Ing. Frank Rhein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105399 - Mixing, Stirring, Agglomeration](#)


Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|----------------|
| ST 2025 | 2245310 | Mixing, Stirring and Agglomeration | 3 SWS | Lecture /  | Rhein |
| Exams | | | | | |
| WT 24/25 | 7291907 | Mixing, Stirring, Agglomeration | | | Nirschl, Rhein |
| ST 2025 | 7291907 | Mixing, Stirring, Agglomeration | | | Nirschl, Rhein |

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

Competence Certificate

Learning control is an oral individual examination with a duration of 30min according SPO section 4, subsection 2.

Prerequisites

None

T

7.119 Course: Modeling Wastewater Treatment Processes [T-BGU-112371]

Responsible: Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: [M-BGU-106113 - Modeling Wastewater Treatment Processes](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|-----------------------------|---------|------------------|------------------|-----------|---------|
| Examination of another type | 6 | Grade to a third | Each summer term | 1 terms | 1 |

| Events | | | | | |
|---------|------------|--|-------|------------------------------|------------------|
| ST 2025 | 6223816 | Modelling Wastewater Treatment Processes | 4 SWS | Lecture / Practice (/ ●) | Azari Najaf Abad |
| Exams | | | | | |
| ST 2025 | 8244112371 | Modeling Wastewater Treatment Processes | | | Azari Najaf Abad |

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

Competence Certificate

written report, appr. 10 pages, and presentation, appr. 10 min.

Prerequisites

none

Recommendation

none


Annotation





The number of participants in the course is limited to 20 persons. The registration is made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

Workload

180 hours

T**7.120 Course: Modelling and Simulation of Electrochemical Systems [T-ETIT-100781]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [M-ETIT-100508 - Modelling and Simulation of Electrochemical Systems](#)**Type**
Oral examination**Credits**
3**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|-------|
| ST 2025 | 2304217 | Modellbildung elektrochemischer Systeme | 2 SWS | Lecture /  | Weber |
| Exams | | | | | |
| WT 24/25 | 7304217 | Modelling and Simulation of Electrochemical Systems | | | Weber |
| ST 2025 | 7304217 | Modelling and Simulation of Electrochemical Systems | | | Weber |

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

none

T**7.121 Course: Modern Concepts in Catalysis: From Science to Engineering [T-CIWVT-114168]**

Responsible: Prof. Dr. Jan-Dierk Grunwaldt
 Prof. Dr. Felix Studt
 Prof. Dr.-Ing. Gregor Wehinger

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-107149 - Modern Concepts in Catalysis: From Science to Engineering](#)





Type
 Oral examination

Credits
 4

Grading scale
 Grade to a third

Version
 1

| Events | | | | | |
|---------|------|---|-------|---|----------------------------|
| ST 2025 | 5443 | Modern Concepts in Catalysis: From Science to Engineering | 2 SWS | Lecture /  | Studt, Grunwaldt, Wehinger |

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

T

7.122 Course: Molecular Biology and Genetics [T-CHEMBIO-103675]

Responsible: Prof. Dr. Jörg Kämper
Prof. Dr. Natalia Requena Sanchez

Organisation: KIT Department of Chemistry and Biosciences




Part of: [M-CHEMBIO-106204 - Molecular Biology and Genetics](#)





Type
Written examination

Credits
5

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|--------------|--|----------------------------------|---|-----------------|
| WT 24/25 | 7301 | Molekularbiologie (BA-04) | 2 SWS | Lecture /  | Requena Sanchez |
| WT 24/25 | 7400721 | KOPIE Genetik (BA-04) | 2 SWS | Lecture /  | Kämper, Kaster |
| WT 24/25 | 7401 | Genetik (BA-04) | 2 SWS | Lecture /  | Kämper, Kaster |
| Exams | | | | | |
| WT 24/25 | 71INF-103675 | Molecular Biology and Genetics | Kämper, Fischer, Requena Sanchez | | |
| ST 2025 | 71103675 | Molecular Biology and Genetics | Requena Sanchez, Fischer, Kämper | | |

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

Prerequisites



none





Workload

150 hours

T

7.123 Course: Nanoparticles – Structure and Function [T-CIWVT-108894]**Responsible:** Dr.-Ing. Jörg Meyer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104339 - Nanoparticles – Structure and Function](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|-----------|--|-------|--|-------|
| ST 2025 | 2244110 | Nanoparticles - Structure and Function | 2 SWS | Lecture /  | Meyer |
| ST 2025 | 2244111 | Nanoparticles - Structure and Function - Exercises | 1 SWS | Practice /  | Meyer |
| Exams | | | | | |
| WT 24/25 | 7244110 | Nanoparticles – Structure and Function | | | Meyer |
| WT 24/25 | 7244110-W | Nanoparticles – Structure and Function | | | Meyer |
| ST 2025 | 7244110 | Nanoparticles – Structure and Function | | | Meyer |

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

The examination is an oral examination with a duration of 30 minutes (single examination) or 20 minutes (comprehensive examination in VF Gas-Partikel-Systeme) (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.124 Course: NMR for Engineers [T-CIWVT-108984]

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104401 - NMR for Engineers](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|-----------|
| WT 24/25 | 2245130 | NMR for Engineers | 2 SWS | Lecture /  | Guthausen |
| WT 24/25 | 2245131 | Laboratory Work for 2245130 NMR for Engineers | 2 SWS | Practical course /  | Guthausen |
| Exams | | | | | |
| WT 24/25 | 7291130 | NMR for Engineers | | | Guthausen |
| ST 2025 | 7291954 | NMR for Engineers | | | Guthausen |

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

Competence Certificate

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

Prerequisites

Labwork must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-109144 - Laboratory Work for NMR for Engineers](#) must have been passed.

T**7.125 Course: NMR Methods for Product and Process Analysis [T-CIWVT-111843]**

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105890 - NMR Methods for Product and Process Analysis](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|-----------------------------------|-----------|---|-----------|
| WT 24/25 | 2245130 | NMR for Engineers | 2 SWS | Lecture /  | Guthausen |
| Exams | | | | | |
| WT 24/25 | 7291130 | NMR for Engineers | Guthausen | | |

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

Competence Certificate

Learning control is an oral examination with a duration of about 30 minutes.

Prerequisites

None.

T

7.126 Course: Nonlinear Process Control [T-CIWVT-112824]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106316 - Nonlinear Process Control](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|---|-------|------------------------------|--------|
| WT 24/25 | 2243050 | Nonlinear Process Control | 3 SWS | Lecture / Practice (/ ●) | Meurer |
| Exams | | | | | |
| WT 24/25 | 7200006 | Nonlinear Process Control | | | Meurer |
| ST 2025 | 7243050 | Nonlinear Process Control | | | Meurer |

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

Prerequisites

None.

T

7.127 Course: Numerical Methods in Fluid Mechanics [T-MATH-105902]

Responsible: Prof. Dr. Willy Dörfler
PD Dr. Gudrun Thäter

Organisation: KIT Department of Mathematics



Part of: [M-MATH-102932 - Numerical Methods in Fluid Mechanics](#)



Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|---------|---------|---|---------|--|---------|
| ST 2025 | 0103100 | Numerische Methoden in der Strömungsmechanik | 2 SWS | Lecture /  | Thäter |
| ST 2025 | 0103110 | Übungen zu 0103100 | 1 SWS | Practice /  | Thäter |
| ST 2025 | 0161600 | Numerical Methods in Fluidmechanics | 2 SWS | Lecture | Dörfler |
| ST 2025 | 0164200 | Numerische Methoden in der Strömungsmechanik | 2 SWS | Lecture | Thäter |
| ST 2025 | 0164210 | Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik) | 1 SWS | Practice | Thäter |
| Exams | | | | | |
| ST 2025 | 7700037 | Numerical Methods in Fluid Mechanics | Dörfler | | |
| ST 2025 | 7700154 | Numerical Methods in Fluid Mechanics | Dörfler | | |

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

T

7.128 Course: Numerical Simulation of Reacting Multiphase Flows [T-CIWVT-114118]



Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107076 - Numerical Simulation of Reacting Multiphase Flows](#)





Type
Oral examination

Credits
3

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|---------|---------|---|-------|--|--------------------------|
| ST 2025 | 2232120 | Numerical Simulation of Reacting Multiphase Flows | 2 SWS | Lecture /  | Stein |
| ST 2025 | 2232121 | Numerical Simulation of Reacting Multiphase Flows - Exercises | 2 SWS | Practice /  | Stein, und Mitarbeitende |
| Exams | | | | | |
| ST 2025 | 7232121 | Numerical Simulation of Reacting Multiphase Flows | | | Stein |

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

Competence Certificate

The learning control ist an oral examination lasting approx. 30 minutes.

Prerequisites

The prerequisite must be passed before taking the oral examination.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-114117 - Numerical Simulation of Reacting Multiphase Flows - Prerequisite](#) must have been passed.

T

7.129 Course: Numerical Simulation of Reacting Multiphase Flows [T-CIWVT-113233]



Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106565 - Numerical Simulation of Reacting Multiphase Flows](#)





Type
Oral examination

Credits
2

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|--------------------------|
| ST 2025 | 2232120 | Numerical Simulation of Reacting Multiphase Flows | 2 SWS | Lecture /  | Stein |
| ST 2025 | 2232121 | Numerical Simulation of Reacting Multiphase Flows - Exercises | 2 SWS | Practice /  | Stein, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232121 | Numerical Simulation of Reacting Multiphase Flows | | | Stein |
| ST 2025 | 7232121 | Numerical Simulation of Reacting Multiphase Flows | | | Stein |

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

Competence Certificate

The learning control ist an oral examination lasting approx. 30 minutes.

Prerequisites

The prerequisite must be passed before taking the oral examination.

Modeled Conditions

The following conditions have to be fulfilled:



1. The course [T-CIWVT-113232 - Numerical Simulation of Reacting Multiphase Flows - Prerequisite](#) must have been passed.





T

7.130 Course: Numerical Simulation of Reacting Multiphase Flows - Prerequisite [T-CIWVT-114117]

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107076 - Numerical Simulation of Reacting Multiphase Flows](#)

| Type | Credits | Grading scale | Version |
|----------------------|---------|---------------|---------|
| Completed coursework | 5 | pass/fail | 1 |

| Events | | | | | |
|---------|---------|--|-------|--|--------------------------|
| ST 2025 | 2232120 | Numerical Simulation of Reacting Multiphase Flows | 2 SWS | Lecture /  | Stein |
| ST 2025 | 2232121 | Numerical Simulation of Reacting Multiphase Flows - Exercises | 2 SWS | Practice /  | Stein, und Mitarbeitende |
| Exams | | | | | |
| ST 2025 | 7232120 | Numerical Simulation of Reacting Multiphase Flows - Prerequisite | Stein | | |

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

Competence Certificate

The learning control is a completed coursework: Reports on the tutorials documenting the processed task, the data generated and their analysis.

Prerequisites



None





T

7.131 Course: Numerical Simulation of Reacting Multiphase Flows - Prerequisite [T-CIWVT-113232]

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106565 - Numerical Simulation of Reacting Multiphase Flows](#)

| Type | Credits | Grading scale | Version |
|----------------------|---------|---------------|---------|
| Completed coursework | 6 | pass/fail | 1 |

| Events | | | | | |
|----------|---------|--|-------|--|--------------------------|
| ST 2025 | 2232120 | Numerical Simulation of Reacting Multiphase Flows | 2 SWS | Lecture /  | Stein |
| ST 2025 | 2232121 | Numerical Simulation of Reacting Multiphase Flows - Exercises | 2 SWS | Practice /  | Stein, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232120 | Numerical Simulation of Reacting Multiphase Flows - Prerequisite | Stein | | |
| ST 2025 | 7232120 | Numerical Simulation of Reacting Multiphase Flows - Prerequisite | Stein | | |

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

Competence Certificate

The learning control is a completed coursework: Reports on the tutorials documenting the processed task, the data generated and their analysis.

Prerequisites

None

T

7.132 Course: Optimal and Model Predictive Control [T-CIWVT-112825]



Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106317 - Optimal and Model Predictive Control](#)





Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|--------|
| ST 2025 | 2243030 | Optimal and Model Predictive Control | 2 SWS | Lecture /  | Meurer |
| ST 2025 | 2243031 | Optimal and Model Predictive Control - Exercises | 1 SWS | Practice /  | Meurer |
| Exams | | | | | |
| WT 24/25 | 7250001 | Optimal and Model Predictive Control | | | Meurer |
| ST 2025 | 7243030 | Optimal and Model Predictive Control | | | Meurer |


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





T

7.133 Course: Organ Support Systems [T-MACH-105228]

Responsible: apl. Prof. Dr. Christian Pylatiuk**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-102702 - Organ Support Systems](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 4 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|----------|------------------|---------------------------------------|-------|---|----------|
| ST 2025 | 2106008 | Organ support systems | 2 SWS | Lecture /  | Pylatiuk |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-105228 | Organ Support Systems | | | Pylatiuk |
| ST 2025 | 76-T-MACH-105228 | Organ Support Systems | | | Pylatiuk |

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

Written examination (Duration: 45min)

Prerequisites

none

Workload

120 hours

T

7.134 Course: Parallel Computing [T-MATH-102271]

Responsible: PD Dr. Mathias Krause
Prof. Dr. Christian Wieners

Organisation: KIT Department of Mathematics



Part of: [M-MATH-101338 - Parallel Computing](#)





Type
Oral examination

Credits
5

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|--------|--|-----------------|
| WT 24/25 | 0100055 | Parallel Computing | 3 SWS | Lecture | Krause, Simonis |
| ST 2025 | 0162000 | Paralleles Rechnen in Theorie und Praxis | 2 SWS | Lecture /  | Krause, Bülow |
| ST 2025 | 0162100 | Übungen zu 0162000 | 2 SWS | Practice /  | Krause, Bülow |
| Exams | | | | | |
| WT 24/25 | 00081 | Parallel Computing | Krause | | |

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

T

7.135 Course: Particle Technology Exam [T-CIWVT-106028]



Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104378 - Particle Technology](#)





Type
Written examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|----------------------------|
| ST 2025 | 2244030 | Particle Technology | 2 SWS | Lecture /  | Dittler |
| ST 2025 | 2244031 | Particle Technology - Exercises | 1 SWS | Practice /  | Dittler, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7244030 | Particle Technology Exam | | | Dittler |
| ST 2025 | 7244030 | Particle Technology Exam | | | Dittler |

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

Competence Certificate

Learning control is a written examination lasting 120 minutes.

Prerequisites

None

T

7.136 Course: Physical Foundations of Cryogenics [T-CIWVT-106103]

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103068 - Physical Foundations of Cryogenics](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|----------|
| ST 2025 | 2250130 | Physical Foundations of Cryogenics | 2 SWS | Lecture /  | Grohmann |
| ST 2025 | 2250131 | Physical Foundations of Cryogenics - Exercises | 1 SWS | Practice /  | Grohmann |
| Exams | | | | | |
| WT 24/25 | 7250130 | Physical Foundations of Cryogenics | | | Grohmann |
| ST 2025 | 7200203 | Physical Foundations of Cryogenics | | | Grohmann |

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

Competence Certificate

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

Prerequisites

None

T

7.137 Course: Polymer Thermodynamics [T-CIWWT-113796]

Responsible: Prof. Dr. Sabine Enders
Prof. Dr.-Ing. Tim Zeiner

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWWT-106882 - Polymer Thermodynamics](#)


Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

| Events | | | | | |
|----------|---------|--|--------|---|--------|
| WT 24/25 | 2250060 | Polymer Thermodynamics | 2 SWS | Lecture /  | Enders |
| Exams | | | | | |
| WT 24/25 | 7250060 | Polymer Thermodynamics | Enders | | |

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

Competence Certificate

Learning control is an oral examination, duration about 30 minutes.

Prerequisites

None

T



7.138 Course: Power-to-X – Key Technology for the Energy Transition [T-CIWVT-111841]





Responsible: Prof. Dr.-Ing. Roland Dittmeyer
Dr. Peter Holtappels

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-105891 - Power-to-X – Key Technology for the Energy Transition](#)

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

| Events | | | | | |
|----------|---------|---|-------|---|-----------------------------|
| WT 24/25 | 2220110 | Power-to-X – Key Technology for the Energy Transition | 2 SWS | Lecture /  | Holtappels, Navarrete Munoz |
| ST 2025 | 2220110 | Power-to-X: Key Technology for the Energy Transition | 2 SWS | Lecture /  | Holtappels, Navarrete Munoz |
| Exams | | | | | |
| WT 24/25 | 7220110 | Power-to-X – Key Technology for the Energy Transition | | | Holtappels |
| ST 2025 | 7220110 | Power-to-X – Key Technology for the Energy Transition | | | Holtappels |

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

Competence Certificate

Oral examination lastin approx. 30 minutes.

Prerequisites

None.

T

7.139 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-CIWVT-104321 - Practical Course Combustion Technology](#)



Type
Oral examination



Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|---------------|
| ST 2025 | 2232060 | Practical Course Combustion Technology | 3 SWS | Practical course /  | Trimis, Harth |
| ST 2025 | 2232321 | Laboratory Work in Combustion Technology | 3 SWS | Practical course /  | Harth |
| Exams | | | | | |
| WT 24/25 | 7231401 | Practical Course Combustion Technology | Harth | | |
| ST 2025 | 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

T


7.140 Course: Practical Course in Water Technology [T-CIWVT-106840]





Responsible: Dr. Andrea Hille-Reichel
Prof. Dr. Harald Horn

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-103440 - Practical Course in Water Technology](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 3 | Grade to a third | Each winter term | 3 |

| Events | | | | | |
|----------|---------|--|-------|---|--|
| WT 24/25 | 2233032 | Practical Course: Water Quality and Water Assessment | 2 SWS | Practical course /  | Horn, Hille-Reichel, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232664 | Practical Course in Water Technology | | | Horn, Hille-Reichel |
| ST 2025 | 7232664 | Practical Course in Water Technology | | | Horn, Hille-Reichel |

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

Competence Certificate

The learning: 6 Experiments including entrance test, protocol; presentation about a selected experiment (about 15 minutes); final test (SPO section 4, subsection 2 No. 3).

Prerequisites

None

Modeled Conditions

The following conditions have to be fulfilled:

1. The module [M-CIWVT-103407 - Water Technology](#) must have been started.
2. The course [T-CIWVT-110866 - Excursions: Water Supply](#) must have been passed.

T



7.141 Course: Practical Course Measurement Techniques in Chemical Processing [T-CIWVT-109182]





Responsible: Prof. Dr.-Ing. Peter Pfeifer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104491 - Catalytic Micro Reactors \(including practical course\)](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------------|---------|
| Completed coursework (practical) | 2 | pass/fail | Each summer term | 1 |

| Events | | | | | |
|----------|---------|--|---------|---|---------------------------------------|
| WT 24/25 | 2220211 | Practical Course for 2220210 Catalytic Micro Reactors | 1 SWS | Practical course /  | Pfeifer, Dittmeyer, und Mitarbeitende |
| ST 2025 | 2220211 | Catalytic Micro Reactors - Practical Course | 1 SWS | Practical course /  | Dittmeyer, Pfeifer, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7210212 | Practical Course Measurement Techniques in Chemical Processing | Pfeifer | | |
| ST 2025 | 7210212 | Practical Course Measurement Techniques in Chemical Processing | Pfeifer | | |

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

Prerequisites

None

T




7.142 Course: Practical Course Measurement Techniques in Chemical Processing [T-CIWVT-109181]





Responsible: Dr.-Ing. Steffen Peter Müller

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104450 - Measurement Techniques in Chemical Processing \(including practical course\)](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------------|---------|
| Completed coursework (practical) | 2 | pass/fail | Each summer term | 1 |

| Events | | | | | |
|----------|---------|--|-------|--|--------|
| ST 2025 | 2220330 | Measurement Techniques in Chemical Processing | 2 SWS | Lecture /  | Müller |
| ST 2025 | 2220331 | Measurement Techniques in Chemical Processing - Practical Course | 1 SWS | Practical course /  | Müller |
| ST 2025 | 2220332 | Measurement Techniques in Chemical Processing - Colloquium | | Colloquium (K /  | Müller |
| Exams | | | | | |
| WT 24/25 | 7210108 | Practical Course Measurement Techniques in Chemical Processing | | | Müller |
| ST 2025 | 7210108 | Practical Course Measurement Techniques in Chemical Processing | | | Müller |

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

Competence Certificate

The examination is an ungraded laboratory work (section 4 subsection 3 SPO).

Prerequisites

None





T

7.143 Course: Practical Course Process Technology and Plant Design [T-CIWVT-106148]

Responsible: Dr. Frederik Scheiff
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104374 - Process Technology](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------------|---------|
| Completed coursework (practical) | 0 | pass/fail | Each winter term | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|----------------------------|
| WT 24/25 | 2231012 | Practical Course Process Technology and Plant Design | 1 SWS | Practical course /  | Scheiff, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7230101 | practical course Process Technology and Plant Design | | | Scheiff |

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

Competence Certificate

Completed coursework/ practical course

Prerequisites

Ungraded exam

Modeled Conditions


The following conditions have to be fulfilled:





1. The course [T-CIWVT-106149 - Initial Exam Process Technology and Plant Design](#) must have been passed.

T

7.144 Course: Practical Course Sol-Gel Processes [T-CIWVT-108823]**Responsible:** Dr.-Ing. Steffen Peter Müller**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104284 - Sol-Gel-Processes \(Including Practical Course\)](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------------------|---------|---------------|------------------|---------|
| Completed coursework (practical) | 2 | pass/fail | Each summer term | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| WT 24/25 | 2220321 | Practical Course for 2220320 Sol-Gel Processes | 1 SWS | Practical course /  | Müller |
| Exams | | | | | |
| WT 24/25 | 7210111 | Practical Course Sol-Gel Processes | | | Müller |
| ST 2025 | 7210111 | Practical Course Sol-Gel Processes | | | Müller |

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

Ungraded laboratory work (section 4, subsection 3 SPO).


Prerequisites





None

T**7.145 Course: Practical in Additive Manufacturing for Process Engineering [T-CIWVT-110903]**

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105407 - Additive Manufacturing for Process Engineering](#)

| Type | Credits | Grading scale | Version |
|----------------------------------|---------|---------------|---------|
| Completed coursework (practical) | 1 | pass/fail | 1 |

| Events | | | | | |
|---------|---------|---|-------|---|-------|
| ST 2025 | 2241021 | Practical in Additive Manufacturing for Process Engineering | 1 SWS | Practical course /  | Klahn |
| Exams | | | | | |
| ST 2025 | 7293102 | Practical in Additive Manufacturing for Process Engineering | | | Klahn |

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

T


7.146 Course: Practical in Power-to-X: Key Technology for the Energy Transition [T-CIWVT-111842]





Responsible: Prof. Dr.-Ing. Roland Dittmeyer
Dr. Peter Holtappels

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-105891 - Power-to-X – Key Technology for the Energy Transition](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|----------------------------------|---------|---------------|------------|-----------|---------|
| Completed coursework (practical) | 2 | pass/fail | Each term | 1 terms | 1 |

| Events | | | | | |
|----------|---------|---|-------|---|-----------------------------|
| ST 2025 | 2220111 | Practical in Power-to-X: Key Technology for the Energy Transition | 1 SWS | Practical course /  | Holtappels, Navarrete Munoz |
| Exams | | | | | |
| WT 24/25 | 7220111 | Practical in Power-to-X: Key Technology for the Energy Transition | | | Holtappels |
| ST 2025 | 7220111 | Practical in Power-to-X: Key Technology for the Energy Transition | | | Holtappels |

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

Competence Certificate

Ungraded lab: Participation in all four experiments.

Prerequisites


None





Annotation

Dates by arrangement, Location: IMVT, KIT Campus Nord, Energy Lab 2.0, Building 605.

T

7.147 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-CIWVT-104886 - Principles of Ceramic and Powder Metallurgy Processing](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|------------------|---|----------------|---|--------|
| WT 24/25 | 2193010 | Basic principles of powder metallurgical and ceramic processing | 2 SWS | Lecture /  | Schell |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | Schell, Wagner | | |
| ST 2025 | 76-T-MACH-102111 | Principles of Ceramic and Powder Metallurgy Processing | Schell | | |

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

Workload

120 hours

T

7.148 Course: Principles of Constrained Static Optimization [T-CIWVT-112811]

Responsible: Dr.-Ing. Pascal Jerono
Prof. Dr.-Ing. Thomas Meurer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106313 - Principles of Constrained Static Optimization](#)

| Type | Credits | Grading scale | Version |
|------------------|---------|------------------|---------|
| Oral examination | 4 | Grade to a third | 1 |


| Events | | | | | |
|----------|---------|---|-------|------------------------------|----------------|
| WT 24/25 | 2243060 | Principles of Constrained Static Optimization | 2 SWS | Lecture / Practice (/ ●) | Meurer, Jerono |
| Exams | | | | | |
| WT 24/25 | 7200054 | Principles of Constrained Static Optimization | | | Jerono |
| ST 2025 | 7243060 | Principles of Constrained Static Optimization | | | Jerono |





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

T

7.149 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-102720 - Principles of Medicine for Engineers](#)

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

| Events | | | | | |
|----------|------------------|--|-------|---|----------|
| WT 24/25 | 2105992 | Principles of Medicine for Engineers | 2 SWS | Lecture /  | Pylatiuk |
| Exams | | | | | |
| WT 24/25 | 76-T-MACH-105235 | Principles of Medicine for Engineers | | | Pylatiuk |
| ST 2025 | 76-T-MACH-105235 | Principles of Medicine for Engineers | | | Pylatiuk |

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

Written examination (Duration: 45min)

Prerequisites

none

Workload

120 hours


T**7.150 Course: Process Analysis: Modeling, Data Mining, Machine Learning [T-ETIT-111214]**





Responsible: Dr.-Ing. Christian Borchert
Prof. Dr.-Ing. Michael Heizmann

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: [M-ETIT-105594 - Process Analysis: Modeling, Data Mining, Machine Learning](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|------------------|---------|------------------|------------------|-----------|---------|
| Oral examination | 4 | Grade to a third | Each summer term | 1 terms | 2 |

| Events | | | | | |
|----------|---------|---|-------|---|----------|
| ST 2025 | 2302145 | Process Analysis: Modeling, Data Mining, Machine Learning | 2 SWS | Lecture /  | Borchert |
| Exams | | | | | |
| WT 24/25 | 7302145 | Process Analysis: Modeling, Data Mining, Machine Learning | | | Borchert |
| ST 2025 | 7302145 | Process Analysis: Modeling, Data Mining, Machine Learning | | | Borchert |

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

T

7.151 Course: Process and Plant Safety [T-CIWVT-108912]

Responsible: Hon.-Prof. Dr. Jürgen Schmidt
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104352 - Process and Plant Safety](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|---------|
| ST 2025 | 2231810 | Process and Plant Safety | 2 SWS | Lecture /  | Schmidt |
| Exams | | | | | |
| WT 24/25 | 7230200 | Process and Plant Safety | | | Schmidt |
| ST 2025 | 7230200 | Process and Plant Safety | | | Schmidt |

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





T

7.152 Course: Process Development in the Chemical Industry [T-CIWVT-108961]

Responsible: Hon.-Prof. Dr. Jürgen Dahlhaus
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104389 - Process Development in the Chemical Industry](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 2 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|---------|---------|--|-------|---|----------|
| ST 2025 | 2260810 | Process Development in the Chemical Industry | 2 SWS | Block /  | Dahlhaus |
| Exams | | | | | |
| ST 2025 | 7280041 | Process Development in the Chemical Industry | | | Dahlhaus |

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

Prerequisites

None

T


7.153 Course: Process Engineering for the Production of Food from Animal Origins [T-CIWVT-113477]





Responsible: PD Dr. Volker Gaukel

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106699 - Process Engineering for the Production of Food from Animal Origins](#)

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

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 2211010 | Process Engineering for the Production of Food from Animal Origins | 2 SWS | Lecture /  | Gaukel |
| Exams | | | | | |
| WT 24/25 | 7211010 | Process Engineering for the Production of Food from Animal Origins | | | Gaukel |
| ST 2025 | 7211010 | Process Engineering for the Production of Food from Animal Origins | | | Gaukel |

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

Competence Certificate


The learning control is an oral examination lasting approx. 30 minutes.





Prerequisites

None

T

7.154 Course: Process Engineering for the Production of Food from Plant-Based Raw Materials [T-CIWVT-113476]**Responsible:** Dr.-Ing. Ulrike van der Schaaf**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106698 - Process Engineering for the Production of Food from Plant-Based Raw Materials](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|----------------|
| WT 24/25 | 2211010 | Process Engineering for the Production of Food From Plant-Based Raw Materials | 2 SWS | Lecture /  | van der Schaaf |
| Exams | | | | | |
| WT 24/25 | 7211011 | Process Engineering for the Production of Food from Plant-Based Raw Materials | | | van der Schaaf |

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

The examination is an oral examination with a duration of about 30 minutes.

Prerequisites

None

**7.155 Course: Process Engineering in Wastewater Treatment [T-BGU-106787]****Responsible:** Dr.-Ing. Tobias Morck**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences**Part of:** [M-BGU-103399 - Process Engineering in Wastewater Treatment](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------------|---------|
| Written examination | 6 | Grade to a third | Each winter term | 1 |

Competence Certificate

written exam, 60 min.

Prerequisites

internal examination prerequisite: group presentation, appr. 20 min., and written report, appr. 10 pages

Recommendation

none

Annotation

not offered anymore

Workload

180 hours

T


7.156 Course: Process Instruments and Machinery and Their Process Integration [T-CIWVT-108910]





Responsible: Dr.-Ing. Manfred Nagel

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104351 - Process Instruments and Machinery and Their Process Integration](#)

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

| Events | | | | | |
|----------|---------|---|-------|---|-------|
| WT 24/25 | 2245820 | Process Instruments and Machinery and Their Process Integration | 2 SWS | Block /  | Nagel |
| Exams | | | | | |
| WT 24/25 | 7291820 | Process Instruments and Machinery and their Process Integration | | | Nagel |

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

T**7.157 Course: Process Modeling in Downstream Processing [T-CIWVT-106101]**

Responsible: apl. Prof. Dr. Matthias Franzreb
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103066 - Process Modeling in Downstream Processing](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|----------|
| ST 2025 | 2214110 | Process Modeling in Downstream Processing | 2 SWS | Lecture /  | Franzreb |
| Exams | | | | | |
| WT 24/25 | 7223015 | Process Modeling in Downstream Processing | | | Franzreb |
| ST 2025 | 7223015 | Process Modeling in Downstream Processing | | | Franzreb |

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

Prerequisites




None





T

7.158 Course: Process Technology and Plant Design Written Exam [T-CIWVT-106150]

Responsible: Dr. Frederik Scheiff
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104374 - Process Technology](#)

| Type | Credits | Grading scale | Recurrence | Version |
|---------------------|---------|------------------|------------|---------|
| Written examination | 8 | Grade to a third | Each term | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|----------------------------|
| WT 24/25 | 2231010 | Process Technology and Plant Design I | 2 SWS | Lecture /  | Scheiff, Bajohr |
| WT 24/25 | 2231012 | Practical Course Process Technology and Plant Design | 1 SWS | Practical course /  | Scheiff, und Mitarbeitende |
| ST 2025 | 2231011 | Process Technology and Plant Design II | 3 SWS | Lecture /  | Scheiff, Bajohr |
| Exams | | | | | |
| WT 24/25 | 7230102 | Process Technology and Plant Design Written Exam | | | Scheiff |
| ST 2025 | 7230102 | Process Technology and Plant Design Written Exam | | | Scheiff |

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

Competence Certificate

Learning control is a written examination lasting 180 minutes.

Prerequisites

None

T**7.159 Course: Processes and Process Chains for Renewable Resources [T-CIWVT-108997]**

Responsible: Prof. Dr. Nicolaus Dahmen
Prof. Dr.-Ing. Jörg Sauer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104422 - Processes and Process Chains for Renewable Resources](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|------------------------------|---------------|
| ST 2025 | 2231210 | Processes and Process Chains for Renewable Resources | 3 SWS | Lecture / Practice (/ 🎧) | Dahmen, Sauer |
| Exams | | | | | |
| WT 24/25 | 7233101 | Processes and Process Chains for Renewable Resources | | | Dahmen, Sauer |
| ST 2025 | 7233101 | Processes and Process Chains for Renewable Resources | | | Dahmen, Sauer |

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


Competence Certificate





Learning control is an oral examination lasting approx. 20 minutes.

Prerequisites

None


T**7.160 Course: Processing of Nanostructured Particles [T-CIWVT-106107]****Responsible:** Prof. Dr.-Ing. Hermann Nirschl**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-103073 - Processing of Nanostructured Particles](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1





| Events | | | | | |
|----------|---------|--|-------|---|---------|
| WT 24/25 | 2245030 | Processing of Nanostructured Particles | 2 SWS | Lecture /  | Nirschl |
| Exams | | | | | |
| WT 24/25 | 7291030 | Processing of Nanostructured Particles | | | Nirschl |
| ST 2025 | 7291921 | Processing of Nanostructured Particles | | | Nirschl |

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

None

T**7.161 Course: Production and Development of Cancer Therapeutics [T-CIWVT-113230]****Responsible:** PD Dr. Gero Leneweit**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106563 - Production and Development of Cancer Therapeutics](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

| Events | | | | | |
|----------|---------|---|-------|---|----------|
| WT 24/25 | 2245420 | Production and Development of Cancer Therapeutics | 2 SWS | Lecture /  | Leneweit |
| Exams | | | | | |
| WT 24/25 | 7291420 | Production and Development of Cancer Therapeutics | | | Leneweit |
| ST 2025 | 7291420 | Production and Development of Cancer Therapeutics | | | Leneweit |

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

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

Prerequisites

None

T

7.162 Course: Reaction Kinetics [T-CIWVT-108821]

Responsible: Dr.-Ing. Steffen Peter Müller
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104283 - Reaction Kinetics](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|--------|
| WT 24/25 | 2220310 | Reaction Kinetics | 2 SWS | Lecture /  | Müller |
| WT 24/25 | 2220311 | Exercises on 2220310 Reaction Kinetics | 1 SWS | Practice /  | Müller |
| Exams | | | | | |
| WT 24/25 | 7210109 | Reaction Kinetics | | | Müller |
| ST 2025 | 7210109 | Reaction Kinetics | | | Müller |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.163 Course: Reactor Modeling with CFD [T-CIWVT-113224]



Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106537 - Reactor Modeling with CFD](#)





Type
Examination of another type

Credits
4

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|---------|---------|--|----------|--|-----------------------------|
| ST 2025 | 2220060 | Reactor Modeling with CFD | 1 SWS | Lecture /  | Wehinger, Reinold |
| ST 2025 | 2220061 | Exercise Reactor Modeling with CFD | 2 SWS | Practice /  | Wehinger, und Mitarbeitende |
| Exams | | | | | |
| ST 2025 | 7220060 | Reactor Modeling with CFD | Wehinger | | |

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

Prerequisites

None.

T

7.164 Course: Refinery Technology - Liquid Fuels [T-CIWVT-108831]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104291 - Refinery Technology - Liquid Fuels](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|--------------------------|
| ST 2025 | 2231120 | Refinery Technology - Liquid Fuels | 2 SWS | Lecture /  | Rauch |
| ST 2025 | 2231121 | Refinery Technology - Exercises | 1 SWS | Practice /  | Rauch, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7230011 | Refinery Technology - Liquid Fuels | Rauch | | |
| ST 2025 | 7230011 | Refinery Technology - Liquid Fuels | Rauch | | |

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



Competence Certificate





The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T**7.165 Course: Refrigeration B - Foundations of Industrial Gas Processing [T-CIWVT-108914]****Responsible:** Prof. Dr.-Ing. Steffen Grohmann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104354 - Refrigeration B - Foundations of Industrial Gas Processing](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|--|-------|--|-----------------------------|
| ST 2025 | 2250120 | Refrigeration B | 2 SWS | Lecture /  | Grohmann |
| ST 2025 | 2250121 | Refrigeration B - Exercises | 1 SWS | Practice /  | Grohmann, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7250120 | Refrigeration B - Foundations of Industrial Gas Processing | | | Grohmann |
| ST 2025 | 7200202 | Refrigeration B - Foundations of Industrial Gas Processing | | | Grohmann |

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

T**7.166 Course: Registration for Certificate Issuance - Supplementary Studies on
Science, Technology and Society [T-FORUM-113587]****Responsible:** Dr. Christine Mielke
Christine Myglas**Organisation:** General Studies. Forum Science and Society (FORUM)**Part of:** [M-FORUM-106753 - Supplementary Studies on Science, Technology and Society](#)

| Type | Credits | Grading scale | Recurrence | Version |
|----------------------|---------|---------------|------------|---------|
| Completed coursework | 0 | pass/fail | Each term | 1 |

Prerequisites

In order to register, it is mandatory that the basic module and the advanced module have been completed and that the grades for the partial performances in the advanced module are available.

Registration as a partial achievement means the issue of a certificate.

T




7.167 Course: Rheology and Processing of Disperse Systems [T-CIWVT-108891]





Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104336 - Rheology and Processing of Disperse Systems](#)

| Type | Credits | Grading scale | Recurrence | Version |
|------------------|---------|------------------|------------|---------|
| Oral examination | 8 | Grade to a third | Each term | 1 |

| Events | | | | | |
|----------|---------|---|-------|---|---------------------------------------|
| WT 24/25 | 2242030 | Stability of Disperse Systems | 2 SWS | Lecture /  | Oelschlaeger, Willenbacher |
| ST 2025 | 2242040 | Rheology of Disperse Systems | 1 SWS | Lecture /  | Willenbacher |
| ST 2025 | 2242110 | Microrheology and High Frequency Rheology | 1 SWS | Lecture /  | Oelschlaeger |
| Exams | | | | | |
| WT 24/25 | 7290103 | Rheology and Processing of Disperse Systems | | | Willenbacher, Oelschlaeger |
| ST 2025 | 7290103 | Rheology and Processing of Disperse Systems | | | Oelschlaeger, Willenbacher, Hochstein |

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

T

7.168 Course: Rheology and Processing of Polymers [T-CIWVT-108890]

Responsible: Dr.-Ing. Bernhard Hochstein
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104335 - Rheology and Processing of Polymers](#)



Type
Oral examination





Credits
8

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|----------------------------|---|--------------|
| ST 2025 | 2242050 | Rheology of Polymers | 2 SWS | Lecture /  | Willenbacher |
| ST 2025 | 2242240 | Rheology and Rheometry | 2 SWS | Lecture /  | Hochstein |
| Exams | | | | | |
| WT 24/25 | 7290104 | Rheology and Processing of Polymers | Willenbacher, Hochstein | | |
| ST 2025 | 7290104 | Rheology and Processing of Polymers | Willenbacher, Hochstein | | |

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

T

7.169 Course: Rheology and Rheometry [T-CIWVT-108881]

Responsible: Dr.-Ing. Bernhard Hochstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104326 - Rheology and Rheometry](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|-----------|
| ST 2025 | 2242240 | Rheology and Rheometry | 2 SWS | Lecture /  | Hochstein |
| Exams | | | | | |
| WT 24/25 | 7290203 | Rheology and Rheometry | | | Hochstein |
| ST 2025 | 7290203 | Rheology and Rheometry | | | Hochstein |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T**7.170 Course: Rheology of Complex Fluids and Advanced Rheometry [T-CIWVT-108886]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104331 - Rheology of Complex Fluids and Advanced Rheometry](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|---|-------|---|-------------------------------|
| ST 2025 | 2242040 | Rheology of Disperse Systems | 1 SWS | Lecture /  | Willenbacher |
| ST 2025 | 2242110 | Microrheology and High Frequency Rheology | 1 SWS | Lecture /  | Oelschlaeger |
| Exams | | | | | |
| WT 24/25 | 7290102 | Rheology of Complex Fluids and Advanced Rheometry | | | Willenbacher, Oelschlaeger |
| ST 2025 | 7290102 | Rheology of Complex Fluids and Advanced Rheometry | | | Oelschlaeger, Willenbacher |

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



7.171 Course: Rheology of Disperse Systems [T-CIWVT-108963]

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104391 - Rheology of Disperse Systems](#)

Type
Oral examination

Credits
2

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--|-------|-----------|--------------|
| ST 2025 | 2242040 | Rheology of Disperse Systems | 1 SWS | Lecture / | Willenbacher |
| Exams | | | | | |
| WT 24/25 | 7290101 | Rheology of Disperse Systems | | | Willenbacher |
| ST 2025 | 7290101 | Rheology of Disperse Systems | | | Willenbacher |

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

Prerequisites

None

T

7.172 Course: Rheology of Polymers [T-CIWVT-108884]

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104329 - Rheology of Polymers](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

| Events | | | | | |
|----------|---------|--------------------------------------|-------|---|--------------|
| ST 2025 | 2242050 | Rheology of Polymers | 2 SWS | Lecture /  | Willenbacher |
| Exams | | | | | |
| WT 24/25 | 7290105 | Rheology of Polymers | | | Willenbacher |
| ST 2025 | 7290105 | Rheology of Polymers | | | Willenbacher |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.173 Course: Seminar Biotechnological Production [T-CIWVT-113830]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104384 - Biotechnological Production](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 2 | Grade to a third | Each summer term | 1 |

| Exams | | | |
|----------|--------------|---|----------|
| WT 24/25 | 7212021-S-BS | Seminar Biotechnological Production | Holtmann |

Competence Certificate

Examination of another type: Seminar talk lasting approx. 10 minutes.

Prerequisites


None



T**7.174 Course: Seminar Mathematics [T-MATH-106541]****Organisation:** KIT Department of Mathematics**Part of:** [M-MATH-103276 - Seminar](#)**Type**
Completed coursework**Credits**
3**Grading scale**
pass/fail**Recurrence**
Each term**Version**
1

| Exams | | | |
|----------|---------|---|----------|
| WT 24/25 | 7700039 | Seminar Mathematics | Kühnlein |
| ST 2025 | 7700026 | Seminar Mathematics (Vert.) | Kühnlein |

T**7.175 Course: Seminar of Food Processing in Practice with Excursion [T-CIWVT-109129]****Responsible:** Dr.-Ing. Nico Leister**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-105932 - Seminar of Food Processing in Practice](#)

| Type | Credits | Grading scale | Recurrence | Version |
|------------------|---------|------------------|------------------|---------|
| Oral examination | 2 | Grade to a third | Each winter term | 3 |

| Events | | | | | |
|----------|---------|---|---------|---|----------------------------|
| WT 24/25 | 2211930 | Seminar Food Processing in Practice, incl. Excursion | 3 SWS | Block /  | Leister, Ellwanger, Martin |
| Exams | | | | | |
| WT 24/25 | 7220017 | Seminar of Food Processing in Practice with Excursion | Leister | | |
| ST 2025 | 7211930 | Seminar of Food Processing in Practice with Excursion | Leister | | |

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

Learning control is an oral exam with a duration of about 20 minutes.

Prerequisites


None





T

7.176 Course: SIL Entrepreneurship Project [T-WIWI-110166]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 3 | Grade to a third | Each winter term | 1 |

| Events | | | | | |
|----------|---------|--|-------|---|-------------|
| WT 24/25 | 2545082 | SIL Entrepreneurship Project | 4 SWS | Seminar | Terzidis |
| ST 2025 | 2545082 | SIL Entrepreneurship Project | | Seminar /  | Mitarbeiter |
| Exams | | | | | |
| WT 24/25 | 7900037 | SIL Entrepreneurship Project | | | Terzidis |

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

Competence Certificate

Alternative exam assessment (§4(2), 3 SPO). The final grade is a result from both, the grade of the term paper and its presentation, as well as active participation during the seminar. In addition, smaller, ungraded tasks are provided in the course to monitor progress.

Prerequisites

None

Recommendation

None

Workload

90 hours

T

7.177 Course: Simulation Technologies - Exam [T-CIWVT-114104]



Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107038 - Simulation Technologies](#)





Type
Oral examination

Credits
3

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|---------|---------|--|-------|--|----------------|
| ST 2025 | 2243090 | Simulation Methods for Dynamic Systems | 2 SWS | Lecture /  | Meurer, Jerono |
| ST 2025 | 2243091 | Simulation Methods for Dynamic Systems - Exercises | 1 SWS | Practice /  | Meurer, Jerono |

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

Competence Certificate

Learning control is an oral examination lasting approx. 45 minutes.

Prerequisites

The prerequisite must be past.

T**7.178 Course: Simulation Technologies - Prerequisite [T-CIWVT-114141]**

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107038 - Simulation Technologies](#)

| Type |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 |

| Grading scale |
|------------------|
| Grade to a third |

| Version |
|---------|
| 1 |

Competence Certificate

Learning control is an examination of another type:
Written elaboration on a programming task.

T

7.179 Course: Single-Cell Technologies [T-CIWVT-113231]


Responsible: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106564 - Single-Cell Technologies](#)





Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|---|------------|
| WT 24/25 | 2213030 | Single-Cell Technologies | 2 SWS | Lecture /  | Grünberger |
| Exams | | | | | |
| WT 24/25 | 7213031 | Single-Cell Technologies | | | Grünberger |
| ST 2025 | 7213030 | Single-Cell Technologies | | | Grünberger |

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

Competence Certificate

The learning control is an oral examination.


Prerequisites





None

T

7.180 Course: Sol-Gel Processes [T-CIWVT-108822]

Responsible: Dr.-Ing. Steffen Peter Müller**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104284 - Sol-Gel-Processes \(Including Practical Course\)](#)
[M-CIWVT-104489 - Sol-Gel Processes](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

| Events | | | | | |
|----------|---------|-----------------------------------|-------|---|--------|
| WT 24/25 | 2220320 | Sol-Gel Processes | 2 SWS | Lecture /  | Müller |
| Exams | | | | | |
| WT 24/25 | 7210110 | Sol-Gel Processes | | | Müller |
| ST 2025 | 7210110 | Sol-Gel Processes | | | Müller |

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

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.181 Course: Solid Liquid Separation [T-CIWVT-108897]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104342 - Solid Liquid Separation](#)



Type
Oral examination





Credits
8

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|-------|
| WT 24/25 | 2245230 | Mechanical Separation Technology | 3 SWS | Lecture /  | Gleiß |
| WT 24/25 | 2245231 | Exercises for 2245230 Mechanical Separation Technology | 1 SWS | Practice /  | Gleiß |
| Exams | | | | | |
| WT 24/25 | 7291230 | Solid Liquid Separation | | | Gleiß |
| ST 2025 | 7291987 | Solid Liquid Separation | | | Gleiß |

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

Competence Certificate

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

Prerequisites

None

T

7.182 Course: Stability of Disperse Systems [T-CIWVT-108885]

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104330 - Stability of Disperse Systems](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|--------------|---|-------------------------------|
| WT 24/25 | 2242030 | Stability of Disperse Systems | 2 SWS | Lecture /  | Oelschlaeger, Willenbacher |
| Exams | | | | | |
| WT 24/25 | 7290106 | Stability of Disperse Systems | Willenbacher | | |
| ST 2025 | 7290106 | Stability of Disperse Systems | Willenbacher | | |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.183 Course: Statistical Thermodynamics [T-CIWVT-106098]



Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103059 - Statistical Thermodynamics](#)





Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|--------|
| ST 2025 | 2250040 | Statistical Thermodynamics | 2 SWS | Lecture /  | Enders |
| ST 2025 | 2250041 | Statistical Thermodynamics - Exercises | 1 SWS | Practice /  | Enders |
| Exams | | | | | |
| WT 24/25 | 7200103 | Statistical Thermodynamics | | | Enders |
| ST 2025 | 7200103 | Statistical Thermodynamics | | | Enders |

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

Competence Certificate

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

Prerequisites

Thermodynamics III

T

7.184 Course: Thermal Process Engineering II [T-CIWVT-114107]



Responsible: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107039 - Thermal Process Engineering II](#)





Type
Written examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|---------|---------|---|--------|--|---------------------------|
| ST 2025 | 2260150 | Thermal Process Engineering II | 2 SWS | Lecture /  | Zeiner |
| ST 2025 | 2260151 | Thermal Process Engineering - Exercises | 2 SWS | Practice /  | Zeiner, und Mitarbeitende |
| Exams | | | | | |
| ST 2025 | 7260150 | Thermal Process Engineering II (previously Thermal Transport Processes) | Zeiner | | |

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

Prerequisites

None.

T**7.185 Course: Thermal Process Engineering III [T-CIWVT-114108]**

Responsible: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-107040 - Thermal Process Engineering III](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 6 | Grade to a third | Each winter term | 1 |

T

7.186 Course: Thermodynamics III [T-CIWVT-106033]



Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103058 - Thermodynamics III](#)





Type
Written examination

Credits
6

Grading scale
Grade to a third

Version
1

| Events | | | | | |
|----------|---------|--|-------|--|---------------------------|
| WT 24/25 | 2250030 | Thermodynamics III | 2 SWS | Lecture /  | Enders |
| WT 24/25 | 2250031 | Thermodynamics III - Exercises | 1 SWS | Practice /  | Enders, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7200104 | Thermodynamics III | | | Enders |
| ST 2025 | 7200104 | Thermodynamics III | | | Enders |

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

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

T

7.187 Course: Thermodynamics of Interfaces [T-CIWVT-106100]


Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103063 - Thermodynamics of Interfaces](#)





Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
2

| Events | | | | | |
|----------|---------|--|-------|---|--------|
| ST 2025 | 2250050 | Thermodynamics of Interfaces | 2 SWS | Lecture /  | Enders |
| Exams | | | | | |
| WT 24/25 | 7200102 | Thermodynamics of Interfaces | | | Enders |
| ST 2025 | 7200102 | Thermodynamics of Interfaces | | | Enders |

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

Competence Certificate

Erfolgskontrolle ist eine mündliche Prüfung im Umfang von 30 Minuten.



7.188 Course: Vacuum Technology [T-CIWVT-109154]

Responsible: Dr.-Ing. Thomas Giegerich

Organisation: KIT Department of Chemical and Process Engineering
KIT Department of Electrical Engineering and Information Technology

Part of: [M-CIWVT-104478 - Vacuum Technology](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|------------|-------------------|
| WT 24/25 | 2250810 | Vacuum Technology | 2 SWS | Lecture / | Giegerich, Tantos |
| WT 24/25 | 2250811 | Vacuum Technology - Exercises | 1 SWS | Practice / | Tantos, Giegerich |
| Exams | | | | | |
| WT 24/25 | 7250810 | Vacuum Technology | | | Giegerich |
| ST 2025 | 7200401 | Vacuum Technology | | | Day |

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

Competence Certificate

The examination is an oral examination with a duration of about 20 minutes (section 4 subsection 2 number 2 SPO).

Prerequisites

None

T

7.189 Course: Wastewater Treatment Technologies [T-BGU-109948]

Responsible: Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad
PD Dr.-Ing. Stephan Fuchs

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

Part of: [M-BGU-104917 - Wastewater Treatment Technologies](#)

| Type | Credits | Grading scale | Recurrence | Expansion | Version |
|---------------------|---------|------------------|------------|-----------|---------|
| Written examination | 6 | Grade to a third | Each term | 1 terms | 4 |

| Events | | | | | |
|----------|------------|---|-------|------------------------------|-------------------------|
| WT 24/25 | 6223801 | Wastewater Treatment Technologies | 4 SWS | Lecture / Practice (/ ●) | Fuchs, Azari Najaf Abad |
| Exams | | | | | |
| WT 24/25 | 8244109948 | Wastewater Treatment Technologies | | | Fuchs, Azari Najaf Abad |
| ST 2025 | 8244109948 | Wastewater Treatment Technologies | | | Fuchs, Azari Najaf Abad |

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

Competence Certificate

written exam, 60 min.

Prerequisites

none

Recommendation

none

Annotation


The number of participants in the course is limited to 30 persons. The registration is to be made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.





Workload

180 hours

T**7.190 Course: Water – Energy – Environment Nexus in a Circular Economy:
Research Proposal Preparation [T-CIWVT-113433]****Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106680 - Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation](#)

| Type | Credits | Grading scale | Recurrence | Version |
|-----------------------------|---------|------------------|------------------|---------|
| Examination of another type | 5 | Grade to a third | Each summer term | 1 |

| Events | | | | | |
|---------|---------|---|-------|---|---------|
| ST 2025 | 2233130 | Circular Economy Water Energy Environment: Research Proposal Preparation | 4 SWS | Lecture /  | Schäfer |
| Exams | | | | | |
| ST 2025 | 7233130 | Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation | | | Schäfer |

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

The Learning control is an examination of another type:

Research proposal of 10 pages and an oral presentation of 10 minutes (individual work). The grade will be a composite of the proposal (submission in week 13 before class) and oral & poster presentation (all day workshop with researcher participation).

Prerequisites

None

T

7.191 Course: Water Technology [T-CIWVT-106802]

Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103407 - Water Technology](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

| Events | | | | | |
|----------|---------|---|-------|--|-------------------------|
| WT 24/25 | 2233030 | Water Technology | 2 SWS | Lecture /  | Horn |
| WT 24/25 | 2233031 | Exercises to Water Technology | 1 SWS | Practice /  | Horn, und Mitarbeitende |
| Exams | | | | | |
| WT 24/25 | 7232621 | Water Technology | | | Horn |
| ST 2025 | 7232621 | Water Technology | | | Horn |

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