

# Module Handbook

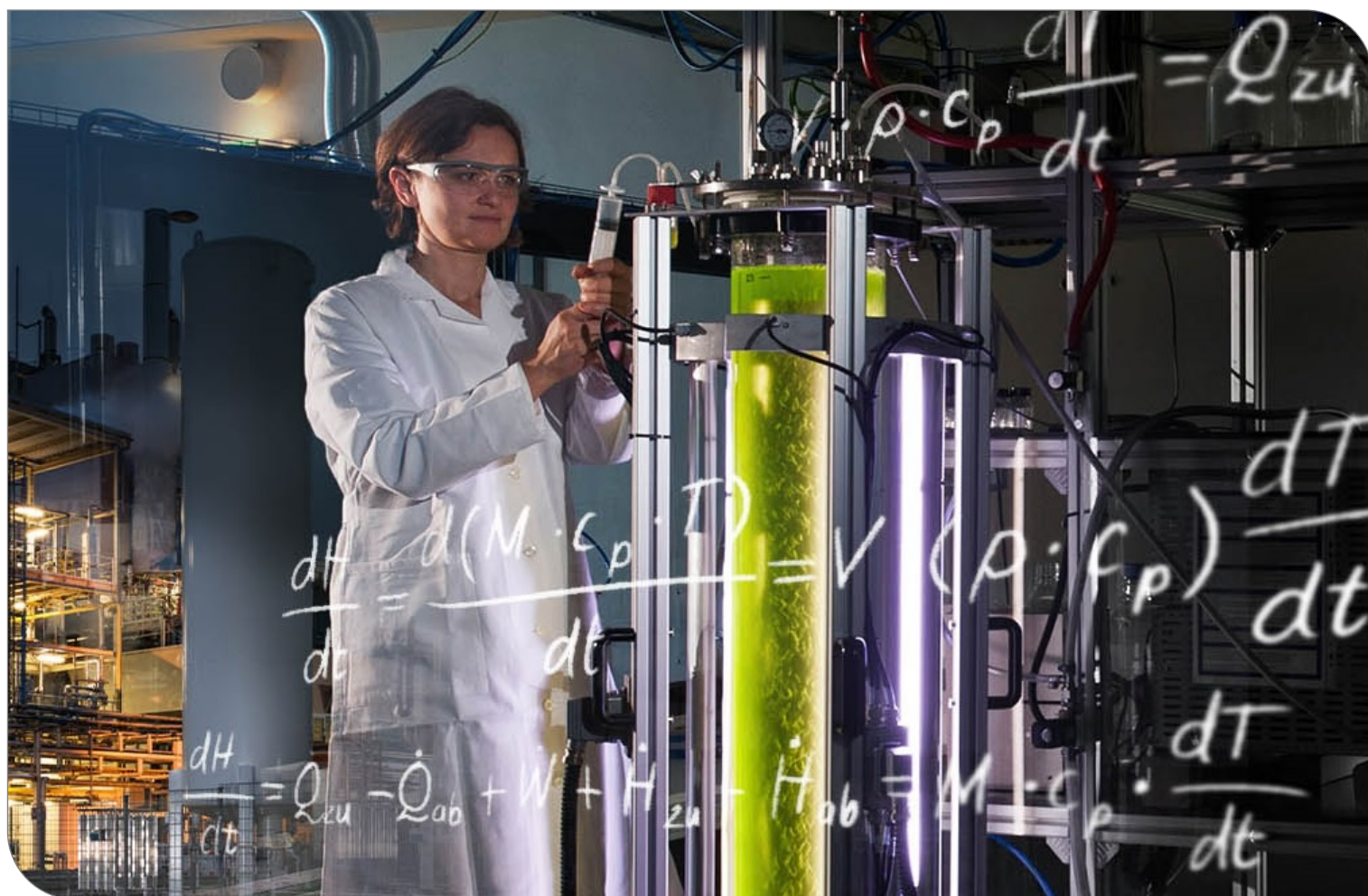
## Bioengineering Master 2016 (Master of Science (M.Sc.))

SPO 2016

Winter term 2024/25

Date: 19/09/2024

KIT DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING



## Table Of Contents

<b>1. General Information</b>	<b>9</b>
1.1. Study program details	9
1.2. Qualification Goals	9
1.3. Studies and Examination Regulations	9
1.4. Organizational issues	10
<b>2. English Courses</b>	<b>11</b>
<b>3. New in Winter Term 2024/25</b>	<b>12</b>
<b>4. Curriculum</b>	<b>13</b>
<b>5. Field of study structure</b>	<b>15</b>
5.1. Master's Thesis	15
5.2. Advanced Fundamentals	15
5.3. Technical Supplement Course	16
5.4. Specialized Course I	21
5.4.1. Applied Rheology	22
5.4.2. Automation and Process Systems Engineering	23
5.4.3. Biopharmaceutical Process Engineering	24
5.4.4. Fuel Technology	25
5.4.5. Chemical Process Engineering	26
5.4.6. Energy Process Engineering	27
5.4.7. Entrepreneurship in Process Engineering	27
5.4.8. Gas Particle Systems	28
5.4.9. Food Process Engineering	29
5.4.10. New Bio-Production Systems - Electro-Biotechnology	30
5.4.11. Bioresource Engineering	31
5.4.12. Mechanical Process Engineering	32
5.4.13. Technical Thermodynamics	33
5.4.14. Thermal Process Engineering	34
5.4.15. Environmental Process Engineering	35
5.4.16. Combustion Technology	35
5.4.17. Water Technology	36
5.5. Internship	36
5.6. Additional Examinations	36
<b>6. Modules</b>	<b>37</b>
6.1. Model Development and Simulation in Thermal Process Engineering - M-CIWVT-106832	37
6.2. Additive Manufacturing for Process Engineering - M-CIWVT-105407	38
6.3. Advanced Methods in Nonlinear Process Control - M-CIWVT-106715	39
6.4. Air Pollution Control - Laws, Technology and Application - M-CIWVT-106314	40
6.5. Alternative Protein Technologies - M-CIWVT-106661	41
6.6. Applied Mass Transfer - Energy Systems and Thin Films - M-CIWVT-106823	43
6.7. Batteries and Fuel Cells - M-ETIT-100532	44
6.8. Battery and Fuel Cells Systems - M-ETIT-100377	45
6.9. Biobased Plastics - M-CIWVT-104570	46
6.10. Biofilm Systems - M-CIWVT-103441	47
6.11. Biomass Based Energy Carriers - M-CIWVT-104288	48
6.12. BioMEMS - Microsystems Technologies for Life Sciences and Medicine I - M-MACH-100489	49
6.13. BioMEMS - Microsystems Technologies for Life Sciences and Medicine II - M-MACH-100490	50
6.14. BioMEMS - Microsystems Technologies for Life Sciences and Medicine III - M-MACH-100491	51
6.15. Biopharmaceutical Purification Processes - M-CIWVT-103065	52
6.16. Bioprocess Development - M-CIWVT-106297	53
6.17. Bioprocess Scale-up - M-CIWVT-106837	55
6.18. Bioreactor Development - M-CIWVT-106595	56
6.19. Biosensors - M-CIWVT-106838	57
6.20. Biotechnological Production - M-CIWVT-104384	58
6.21. Biotechnological Use of Renewable Resources - M-CIWVT-105295	59
6.22. C1-Biotechnology - M-CIWVT-106816	60
6.23. Catalytic Micro Reactors - M-CIWVT-104451	61

6.24. Catalytic Micro Reactors (including practical course) - M-CIWVT-104491 .....	62
6.25. Catalytic Processes in Gas Technologies - M-CIWVT-104287 .....	63
6.26. Chemical Hydrogen Storage - M-CIWVT-106566 .....	64
6.27. Chemical Process Engineering II - M-CIWVT-104281 .....	65
6.28. Chem-Plant - M-CIWVT-104461 .....	66
6.29. Circular Economy - M-CIWVT-106881 .....	67
6.30. Combustion and Environment - M-CIWVT-104295 .....	68
6.31. Combustion Technology - M-CIWVT-103069 .....	69
6.32. Commercial Biotechnology - M-CIWVT-104273 .....	71
6.33. Computational Fluid Dynamics - M-CIWVT-103072 .....	72
6.34. Computational Fluid Dynamics and Simulation Lab - M-MATH-106634 .....	73
6.35. Computer-Aided Reactor Design - M-CIWVT-106809 .....	74
6.36. Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids - M-CIWVT-104328 .....	75
6.37. Control of Distributed Parameter Systems - M-CIWVT-106318 .....	76
6.38. Cryogenic Engineering - M-CIWVT-104356 .....	77
6.39. Data Analysis and Statistics - M-CIWVT-104345 .....	78
6.40. Data-Based Modeling and Control - M-CIWVT-106319 .....	79
6.41. Data-Driven Process Engineering Models in Python - M-CIWVT-106835 .....	80
6.42. Design of a Jet Engine Combustion Chamber - M-CIWVT-105206 .....	81
6.43. Design of Micro Reactors - M-CIWVT-104286 .....	82
6.44. Development of an Innovative Food Product - M-CIWVT-104388 .....	83
6.45. Digital Design in Process Engineering - M-CIWVT-105782 .....	84
6.46. Digitization in Particle Technology - M-CIWVT-104973 .....	85
6.47. Dimensional Analysis of Fluid Mechanic Problems - M-CIWVT-104327 .....	86
6.48. Drying Technology - M-CIWVT-104370 .....	87
6.49. Dynamics of Mechanical and Process Engineering Systems - M-CIWVT-106704 .....	88
6.50. Electrobiotechnology - M-CIWVT-106518 .....	89
6.51. Electrocatalysis - M-ETIT-105883 .....	90
6.52. Electrochemistry - M-CHEMBIO-106697 .....	91
6.53. Energy Technology - M-CIWVT-104293 .....	92
6.54. Environmental Biotechnology - M-CIWVT-104320 .....	93
6.55. Estimator and Observer Design - M-CIWVT-106320 .....	94
6.56. Extrusion Technology in Food Processing - M-CIWVT-105996 .....	95
6.57. Flow and Combustion Instabilities in Technical Burner Systems - M-CIWVT-104294 .....	96
6.58. Fluid Mechanics of Non Newtonian Fluids - M-CIWVT-104322 .....	97
6.59. Fluidized Bed Technology - M-CIWVT-104292 .....	98
6.60. Food Chemistry Basics - M-CHEMBIO-104620 .....	99
6.61. Food Science and Functionality - M-CIWVT-104263 .....	100
6.62. Formulation of (Bio)pharmaceutical Therapeutics - M-CIWVT-104266 .....	101
6.63. Fuel Technology - M-CIWVT-104289 .....	102
6.64. Fundamentals of Water Quality - M-CIWVT-103438 .....	103
6.65. Fungal Biology and Biotechnology - M-CIWVT-106507 .....	104
6.66. Gas Particle Measurement Technology - M-CIWVT-104337 .....	105
6.67. Gas Particle Separation Processes - M-CIWVT-104340 .....	106
6.68. Heat Exchangers - M-CIWVT-104371 .....	107
6.69. Heat Transfer II - M-CIWVT-103051 .....	108
6.70. High Temperature Process Engineering - M-CIWVT-103075 .....	109
6.71. Hydrogen and Fuel Cell Technologies - M-CIWVT-104296 .....	110
6.72. Industrial Aspects in Bioprocess Technology - M-CIWVT-105412 .....	112
6.73. Industrial Biocatalysis - M-CIWVT-106678 .....	113
6.74. Industrial Bioprocesses - M-CIWVT-106501 .....	114
6.75. Industrial Genetics - M-CIWVT-106681 .....	115
6.76. Industrial Wastewater Treatment - M-CIWVT-105903 .....	116
6.77. Innovation Management for Products & Processes in the Chemical Industry - M-CIWVT-104397 .....	117
6.78. Innovative Concepts for Formulation and Processing of Printable Materials - M-CIWVT-105993 .....	119
6.79. Instrumental Analytics - M-CIWVT-104560 .....	120
6.80. Internship - M-CIWVT-104527 .....	121
6.81. Introduction to Numerical Simulation of Reacting Flows - M-CIWVT-106676 .....	122
6.82. Introduction to Sensory Analysis - M-CIWVT-105933 .....	123
6.83. Journal Club - Novel Bioproduction Systems - M-CIWVT-106526 .....	124

6.84. Kinetics and Catalysis - M-CIWVT-104383 .....	125
6.85. Liquid Transportation Fuels - M-CIWVT-105200 .....	126
6.86. Mass Transfer II - M-CIWVT-104369 .....	127
6.87. Materials and Processes for Electrochemical Storage - M-CIWVT-104353 .....	128
6.88. Measurement Techniques in Chemical Processing - M-CIWVT-104490 .....	129
6.89. Measurement Techniques in Chemical Processing (including practical course) - M-CIWVT-104450 .....	130
6.90. Measurement Techniques in the Thermo-Fluid Dynamics - M-CIWVT-104297 .....	131
6.91. Membrane Materials & Processes Research Masterclass - M-CIWVT-106529 .....	133
6.92. Membrane Reactors - M-CIWVT-105663 .....	134
6.93. Membrane Technologies in Water Treatment - M-CIWVT-105380 .....	135
6.94. Microbiology for Engineers - M-CIWVT-104319 .....	137
6.95. Microfluidics - M-CIWVT-104350 .....	138
6.96. Microfluidics and Case Studies - M-CIWVT-105205 .....	139
6.97. Microrheology and High Frequency Rheology - M-CIWVT-104395 .....	140
6.98. Mixing, Stirring, Agglomeration - M-CIWVT-105399 .....	141
6.99. Modeling Wastewater Treatment Processes - M-BGU-106113 .....	142
6.100. Modelling and Simulation of Electrochemical Systems - M-ETIT-100508 .....	144
6.101. Module Master's Thesis - M-CIWVT-104526 .....	145
6.102. Nanoparticles – Structure and Function - M-CIWVT-104339 .....	146
6.103. NMR for Engineers - M-CIWVT-104401 .....	147
6.104. NMR Methods for Product and Process Analysis - M-CIWVT-105890 .....	148
6.105. Nonlinear Process Control - M-CIWVT-106316 .....	149
6.106. Numerical Methods in Fluid Mechanics - M-MATH-102932 .....	150
6.107. Numerical Simulation of Reacting Multiphase Flows - M-CIWVT-106565 .....	151
6.108. Optimal and Model Predictive Control - M-CIWVT-106317 .....	153
6.109. Organ Support Systems - M-MACH-102702 .....	154
6.110. Parallel Computing - M-MATH-101338 .....	155
6.111. Particle Technology - M-CIWVT-104378 .....	156
6.112. Physical Chemistry (incl. Lab) - M-CHEMBIO-104486 .....	157
6.113. Physical Foundations of Cryogenics - M-CIWVT-103068 .....	159
6.114. Polymer Thermodynamics - M-CIWVT-106882 .....	160
6.115. Power-to-X – Key Technology for the Energy Transition - M-CIWVT-105891 .....	161
6.116. Practical Course Combustion Technology - M-CIWVT-104321 .....	163
6.117. Practical Course in Water Technology - M-CIWVT-103440 .....	164
6.118. Principles of Ceramic and Powder Metallurgy Processing - M-CIWVT-104886 .....	166
6.119. Principles of Constrained Static Optimization - M-CIWVT-106313 .....	167
6.120. Principles of Medicine for Engineers - M-MACH-102720 .....	168
6.121. Process Analysis: Modeling, Data Mining, Machine Learning - M-ETIT-105594 .....	169
6.122. Process and Plant Safety - M-CIWVT-104352 .....	170
6.123. Process Development in the Chemical Industry - M-CIWVT-104389 .....	171
6.124. Process Engineering for the Production of Food from Animal Origins - M-CIWVT-106699 .....	172
6.125. Process Engineering for the Production of Food from Plant-Based Raw Materials - M-CIWVT-106698 .....	173
6.126. Process Engineering in Wastewater Treatment - M-BGU-103399 .....	174
6.127. Process Instruments and Machinery and Their Process Integration - M-CIWVT-104351 .....	176
6.128. Process Modeling in Downstream Processing - M-CIWVT-103066 .....	177
6.129. Process Technology - M-CIWVT-104374 .....	178
6.130. Processes and Process Chains for Renewable Resources - M-CIWVT-104422 .....	179
6.131. Processing of Nanostructured Particles - M-CIWVT-103073 .....	180
6.132. Product Development – Methods of Product Engineering - M-MACH-102718 .....	181
6.133. Production and Development of Cancer Therapeutics - M-CIWVT-106563 .....	183
6.134. Reaction Kinetics - M-CIWVT-104283 .....	184
6.135. Reactor Modeling with CFD - M-CIWVT-106537 .....	185
6.136. Refinery Technology - Liquid Fuels - M-CIWVT-104291 .....	186
6.137. Refrigeration B - Foundations of Industrial Gas Processing - M-CIWVT-104354 .....	187
6.138. Rheology and Processing of Disperse Systems - M-CIWVT-104336 .....	188
6.139. Rheology and Processing of Polymers - M-CIWVT-104335 .....	189
6.140. Rheology and Rheometry - M-CIWVT-104326 .....	190
6.141. Rheology of Complex Fluids and Advanced Rheometry - M-CIWVT-104331 .....	191
6.142. Rheology of Disperse Systems - M-CIWVT-104391 .....	192
6.143. Rheology of Polymers - M-CIWVT-104329 .....	193

6.144. Seminar - M-MATH-103276 .....	194
6.145. Seminar of Food Processing in Practice - M-CIWVT-105932 .....	195
6.146. Single-Cell Technologies - M-CIWVT-106564 .....	196
6.147. Sol-Gel Processes - M-CIWVT-104489 .....	198
6.148. Sol-Gel-Processes (Including Practical Course) - M-CIWVT-104284 .....	199
6.149. Solid Liquid Separation - M-CIWVT-104342 .....	200
6.150. Stability of Disperse Systems - M-CIWVT-104330 .....	201
6.151. Statistical Thermodynamics - M-CIWVT-103059 .....	202
6.152. Students Innovation Lab - M-CIWVT-106017 .....	203
6.153. Supplementary Studies on Science, Technology and Society - M-FORUM-106753 .....	205
6.154. Surface Effects in Process Engineering - M-CIWVT-104452 .....	209
6.155. Thermal Transport Processes - M-CIWVT-104377 .....	210
6.156. Thermodynamics III - M-CIWVT-103058 .....	211
6.157. Thermodynamics of Interfaces - M-CIWVT-103063 .....	212
6.158. Vacuum Technology - M-CIWVT-104478 .....	213
6.159. Wastewater Treatment Technologies - M-BGU-104917 .....	214
6.160. Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation - M-CIWVT-106680	216
6.161. Water Technology - M-CIWVT-103407 .....	217
<b>7. Courses .....</b>	<b>218</b>
7.1. Model Development and Simulation in Thermal Process Engineering - T-CIWVT-113702 .....	218
7.2. Additive Manufacturing for Process Engineering - Examination - T-CIWVT-110902 .....	219
7.3. Advanced Methods in Nonlinear Process Control - T-CIWVT-113490 .....	220
7.4. Air Pollution Control - Laws, Technology and Application - T-CIWVT-112812 .....	221
7.5. Alternative Protein Technologies - T-CIWVT-113429 .....	222
7.6. Applied Mass Transfer - Energy Systems and Thin Films - T-CIWVT-113692 .....	223
7.7. Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113579	224
7.8. Batteries and Fuel Cells - T-ETIT-100983 .....	225
7.9. Battery and Fuel Cells Systems - T-ETIT-100704 .....	226
7.10. Biobased Plastics - T-CIWVT-109369 .....	227
7.11. Biofilm Systems - T-CIWVT-106841 .....	228
7.12. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I - T-MACH-100966 .....	229
7.13. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II - T-MACH-100967 .....	230
7.14. BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III - T-MACH-100968 .....	231
7.15. Biopharmaceutical Purification Processes - T-CIWVT-106029 .....	232
7.16. Bioprocess Development - T-CIWVT-112766 .....	233
7.17. Bioprocess Scale-up - T-CIWVT-113712 .....	234
7.18. Bioreactor Development - T-CIWVT-113315 .....	235
7.19. Biosensors - T-CIWVT-113714 .....	236
7.20. Biotechnological Production - T-CIWVT-113831 .....	237
7.21. Biotechnological Use of Renewable Resources - T-CIWVT-113237 .....	238
7.22. C1-Biotechnology Exam - T-CIWVT-113677 .....	239
7.23. C1-Biotechnology Presentation - T-CIWVT-113678 .....	240
7.24. Catalytic Micro Reactors - T-CIWVT-109087 .....	241
7.25. Catalytic Processes in Gas Technologies - T-CIWVT-108827 .....	242
7.26. Chemical Hydrogen Storage - T-CIWVT-113234 .....	243
7.27. Chemical Process Engineering II - T-CIWVT-108817 .....	244
7.28. Chem-Plant - T-CIWVT-109127 .....	245
7.29. Circular Economy - T-CIWVT-113815 .....	246
7.30. Combustion and Environment - T-CIWVT-108835 .....	247
7.31. Combustion Technology - T-CIWVT-106104 .....	248
7.32. Commercial Biotechnology - T-CIWVT-108811 .....	249
7.33. Computational Fluid Dynamics - T-CIWVT-106035 .....	250
7.34. Computational Fluid Dynamics and Simulation Lab - T-MATH-113373 .....	251
7.35. Computer-Aided Reactor Design - T-CIWVT-113667 .....	252
7.36. Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids - T-CIWVT-108883 .....	253
7.37. Control of Distributed Parameter Systems - T-CIWVT-112826 .....	254
7.38. Cryogenic Engineering - T-CIWVT-108915 .....	255
7.39. Data Analysis and Statistics - T-CIWVT-108900 .....	256
7.40. Data-Based Modeling and Control - T-CIWVT-112827 .....	257
7.41. Data-Driven Models in Python - Process Engineering Project - T-CIWVT-113708 .....	258

7.42. Data-Driven Process Engineering Models in Python - Exam - T-CIWVT-113709 .....	259
7.43. Design of a Jet Engine Combustion Chamber - T-CIWVT-110571 .....	260
7.44. Design of Micro Reactors - T-CIWVT-108826 .....	261
7.45. Development of an Innovative Food Product - T-CIWVT-108960 .....	262
7.46. Development of an Innovative Food Product - presentation - T-CIWVT-111010 .....	263
7.47. Digital Design in Process Engineering - Laboratory - T-CIWVT-111582 .....	264
7.48. Digital Design in Process Engineering - Oral Examination - T-CIWVT-111583 .....	265
7.49. Digitization in Particle Technology - T-CIWVT-110111 .....	266
7.50. Dimensional Analysis of Fluid Mechanic Problems - T-CIWVT-108882 .....	267
7.51. Drying Technology - T-CIWVT-108936 .....	268
7.52. Dynamics of Mechanical and Process Engineering Systems - Exam - T-CIWVT-113486 .....	269
7.53. Dynamics of Mechanical and Process Engineering Systems - Prerequisite - T-CIWVT-113485 .....	270
7.54. Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration - T-FORUM-113580 .....	271
7.55. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration - T-FORUM-113582 .....	272
7.56. Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration - T-FORUM-113581 .....	273
7.57. Electrobiotechnology - T-CIWVT-113148 .....	274
7.58. Electrobiotechnology Seminar - T-CIWVT-113829 .....	275
7.59. Electrocatalysis - T-ETIT-111831 .....	276
7.60. Electrochemistry - T-CHEMBIO-109773 .....	277
7.61. Energy from Biomass - T-CIWVT-108828 .....	278
7.62. Energy Technology - T-CIWVT-108833 .....	279
7.63. Entrepreneurship - T-WIWI-102864 .....	280
7.64. Environmental Biotechnology - T-CIWVT-106835 .....	281
7.65. Estimator and Observer Design - T-CIWVT-112828 .....	282
7.66. Exercises: Membrane Technologies - T-CIWVT-113235 .....	283
7.67. Excursions: Water Supply - T-CIWVT-110866 .....	284
7.68. Extrusion Technology in Food Processing - T-CIWVT-112174 .....	285
7.69. Flow and Combustion Instabilities in Technical Burner Systems - T-CIWVT-108834 .....	286
7.70. Fluid Mechanics of Non-Newtonian Fluids - T-CIWVT-108874 .....	287
7.71. Fluidized Bed Technology - T-CIWVT-108832 .....	288
7.72. Food Chemistry Basics - T-CHEMBIO-109442 .....	289
7.73. Food Science and Functionality - T-CIWVT-108801 .....	290
7.74. Formulation of (Bio)pharmaceutical Therapeutics - T-CIWVT-108805 .....	291
7.75. Fuel Technology - T-CIWVT-108829 .....	292
7.76. Fundamentals of Water Quality - T-CIWVT-106838 .....	293
7.77. Fungal Biology Biotechnology - T-CIWVT-113150 .....	294
7.78. Fungal Biology Biotechnology Seminar - T-CIWVT-113125 .....	295
7.79. Gas Particle Measurement Technology - T-CIWVT-108892 .....	296
7.80. Gas Particle Separation Processes - T-CIWVT-108895 .....	297
7.81. Heat Exchangers - T-CIWVT-108937 .....	298
7.82. Heat Transfer II - T-CIWVT-106067 .....	299
7.83. High Temperature Process Engineering - T-CIWVT-106109 .....	300
7.84. Hydrogen and Fuel Cell Technologies - T-CIWVT-108836 .....	301
7.85. Industrial Aspects in Bioprocess Technology - T-CIWVT-110935 .....	302
7.86. Industrial Biocatalysis - T-CIWVT-113432 .....	303
7.87. Industrial Bioprocesses - T-CIWVT-113120 .....	304
7.88. Industrial Genetics - T-CIWVT-113434 .....	305
7.89. Industrial Wastewater Treatment - T-CIWVT-111861 .....	306
7.90. Initial Exam Process Technology and Plant Design - T-CIWVT-106149 .....	307
7.91. Innovation Management for Products & Processes in the Chemical Industry - T-CIWVT-108980 .....	308
7.92. Innovation Project Electronic Devices from Printable Conductive Materials - T-CIWVT-113226 .....	309
7.93. Innovation Project Porous Ceramics from the 3D Printer - T-CIWVT-112201 .....	310
7.94. Innovative Concepts for Formulation and Processing of Printable Materials - T-CIWVT-112170 .....	311
7.95. Instrumental Analytics - T-CIWVT-106837 .....	312
7.96. Internship - T-CIWVT-109276 .....	313
7.97. Introduction to Numerical Simulation of Reacting Flows - T-CIWVT-113436 .....	314
7.98. Introduction to Numerical Simulation of Reacting Flows - Prerequisite - T-CIWVT-113435 .....	315

7.99. Introduction to Sensory Analysis with Practice - T-CIWVT-109128 .....	316
7.100. Journal Club - Novel Bioproduction Systems - T-CIWVT-113149 .....	317
7.101. Kinetics and Catalysis - T-CIWVT-106032 .....	318
7.102. Laboratory Work for NMR for Engineers - T-CIWVT-109144 .....	319
7.103. Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration - T-FORUM-113578 .....	320
7.104. Liquid Transportation Fuels - T-CIWVT-111095 .....	321
7.105. Mass Transfer II - T-CIWVT-108935 .....	322
7.106. Master's Thesis - T-CIWVT-109275 .....	323
7.107. Materials and Processes for Electrochemical Storage - T-CIWVT-108146 .....	324
7.108. Measurement Techniques in Chemical Processing - T-CIWVT-109086 .....	325
7.109. Measurement Techniques in the Thermo-Fluid Dynamics - T-CIWVT-108837 .....	326
7.110. Membrane Materials & Processes Research Masterclass - T-CIWVT-113153 .....	327
7.111. Membrane Reactors - T-CIWVT-111314 .....	328
7.112. Membrane Technologies in Water Treatment - T-CIWVT-113236 .....	329
7.113. Methods and Processes of PGE - Product Generation Engineering - T-MACH-109192 .....	330
7.114. Microbiology for Engineers - T-CIWVT-106834 .....	331
7.115. Microfluidics - T-CIWVT-108909 .....	332
7.116. Microfluidics - Case Studies - T-CIWVT-110549 .....	333
7.117. Microrheology and High Frequency Rheology - T-CIWVT-108977 .....	334
7.118. Mixing, Stirring, Agglomeration - T-CIWVT-110895 .....	335
7.119. Modeling Wastewater Treatment Processes - T-BGU-112371 .....	336
7.120. Modelling and Simulation of Electrochemical Systems - T-ETIT-100781 .....	337
7.121. Nanoparticles – Structure and Function - T-CIWVT-108894 .....	338
7.122. NMR for Engineers - T-CIWVT-108984 .....	339
7.123. NMR Methods for Product and Process Analysis - T-CIWVT-111843 .....	340
7.124. Nonlinear Process Control - T-CIWVT-112824 .....	341
7.125. Numerical Methods in Fluid Mechanics - T-MATH-105902 .....	342
7.126. Numerical Simulation of Reacting Multiphase Flows - T-CIWVT-113233 .....	343
7.127. Numerical Simulation of Reacting Multiphase Flows - Prerequisite - T-CIWVT-113232 .....	344
7.128. Optimal and Model Predictive Control - T-CIWVT-112825 .....	345
7.129. Organ Support Systems - T-MACH-105228 .....	346
7.130. Parallel Computing - T-MATH-102271 .....	347
7.131. Particle Technology Exam - T-CIWVT-106028 .....	348
7.132. Physical Chemistry (Lab) - T-CHEMBIO-109179 .....	349
7.133. Physical Chemistry (Written Exam) - T-CHEMBIO-109178 .....	350
7.134. Physical Foundations of Cryogenics - T-CIWVT-106103 .....	351
7.135. Polymer Thermodynamics - T-CIWVT-113796 .....	352
7.136. Power-to-X – Key Technology for the Energy Transition - T-CIWVT-111841 .....	353
7.137. Practical Course Combustion Technology - T-CIWVT-108873 .....	354
7.138. Practical Course in Water Technology - T-CIWVT-106840 .....	355
7.139. Practical Course Measurement Techniques in Chemical Processing - T-CIWVT-109181 .....	356
7.140. Practical Course Measurement Techniques in Chemical Processing - T-CIWVT-109182 .....	357
7.141. Practical Course Process Technology and Plant Design - T-CIWVT-106148 .....	358
7.142. Practical Course Sol-Gel Processes - T-CIWVT-108823 .....	359
7.143. Practical in Additive Manufacturing for Process Engineering - T-CIWVT-110903 .....	360
7.144. Practical in Power-to-X: Key Technology for the Energy Transition - T-CIWVT-111842 .....	361
7.145. Principles of Ceramic and Powder Metallurgy Processing - T-MACH-102111 .....	362
7.146. Principles of Constrained Static Optimization - T-CIWVT-112811 .....	363
7.147. Principles of Medicine for Engineers - T-MACH-105235 .....	364
7.148. Process Analysis: Modeling, Data Mining, Machine Learning - T-ETIT-111214 .....	365
7.149. Process and Plant Safety - T-CIWVT-108912 .....	366
7.150. Process Development in the Chemical Industry - T-CIWVT-108961 .....	367
7.151. Process Engineering for the Production of Food from Animal Origins - T-CIWVT-113477 .....	368
7.152. Process Engineering for the Production of Food from Plant-Based Raw Materials - T-CIWVT-113476 .....	369
7.153. Process Engineering in Wastewater Treatment - T-BGU-106787 .....	370
7.154. Process Instruments and Machinery and Their Process Integration - T-CIWVT-108910 .....	371
7.155. Process Modeling in Downstream Processing - T-CIWVT-106101 .....	372
7.156. Process Technology and Plant Design Written Exam - T-CIWVT-106150 .....	373
7.157. Processes and Process Chains for Renewable Resources - T-CIWVT-108997 .....	374

7.158. Processing of Nanostructured Particles - T-CIWVT-106107 .....	375
7.159. Production and Development of Cancer Therapeutics - T-CIWVT-113230 .....	376
7.160. Reaction Kinetics - T-CIWVT-108821 .....	377
7.161. Reactor Modeling with CFD - T-CIWVT-113224 .....	378
7.162. Refinery Technology - Liquid Fuels - T-CIWVT-108831 .....	379
7.163. Refrigeration B - Foundations of Industrial Gas Processing - T-CIWVT-108914 .....	380
7.164. Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society - T-FORUM-113587 .....	381
7.165. Rheology and Processing of Disperse Systems - T-CIWVT-108891 .....	382
7.166. Rheology and Processing of Polymers - T-CIWVT-108890 .....	383
7.167. Rheology and Rheometry - T-CIWVT-108881 .....	384
7.168. Rheology of Complex Fluids and Advanced Rheometry - T-CIWVT-108886 .....	385
7.169. Rheology of Disperse Systems - T-CIWVT-108963 .....	386
7.170. Rheology of Polymers - T-CIWVT-108884 .....	387
7.171. Seminar Biotechnological Production - T-CIWVT-113830 .....	388
7.172. Seminar Mathematics - T-MATH-106541 .....	389
7.173. Seminar of Food Processing in Practice with Excursion - T-CIWVT-109129 .....	390
7.174. SIL Entrepreneurship Project - T-WIWI-110166 .....	391
7.175. Single-Cell Technologies - T-CIWVT-113231 .....	392
7.176. Sol-Gel Processes - T-CIWVT-108822 .....	393
7.177. Solid Liquid Separation - T-CIWVT-108897 .....	394
7.178. Stability of Disperse Systems - T-CIWVT-108885 .....	395
7.179. Statistical Thermodynamics - T-CIWVT-106098 .....	396
7.180. Surface Effects in Process Engineering - T-CIWVT-109088 .....	397
7.181. Thermal Transport Processes - T-CIWVT-106034 .....	398
7.182. Thermodynamics III - T-CIWVT-106033 .....	399
7.183. Thermodynamics of Interfaces - T-CIWVT-106100 .....	400
7.184. Vacuum Technology - T-CIWVT-109154 .....	401
7.185. Wastewater Treatment Technologies - T-BGU-109948 .....	402
7.186. Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation - T-CIWVT-113433 .....	403
7.187. Water Technology - T-CIWVT-106802 .....	404



## 1 General Information

### 1.1 Study program details

<b>KIT-Department</b>	KIT Department of Chemical and Process Engineering
<b>Academic Degree</b>	Master of Science (M.Sc.)
<b>Examination Regulations Version</b>	2016
<b>Regular terms</b>	4 terms
<b>Maximum terms</b>	8 terms
<b>Credits</b>	120
<b>Language</b>	Deutsch, teilweise Englisch
<b>Grade calculation</b>	Weighted average by credits
<b>Additional Information</b>	Link to study program <a href="http://www.ciw.kit.edu">www.ciw.kit.edu</a> Department <a href="https://www.ciw.kit.edu/1630.php">https://www.ciw.kit.edu/1630.php</a> Business unit Studium und Lehre <a href="https://www.sle.kit.edu/vorstudium/master-bioingenieurwesen.php">https://www.sle.kit.edu/vorstudium/master-bioingenieurwesen.php</a>

### 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](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

If the Soft Skill Qualification is taken at the HoC or Language Centre, 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	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
• Nonlinear Process Control	6 LP	WS
• Numerical Methods in Fluidmechanics	4 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 WINTERSEMESTER 2024/25

### Neue Module

- Angewandte Stoffübertragung – Energie- und Dünnschichtsysteme  
Prof. Dr.-Ing. Wilhelm Schabel/ 4 SWS/ 8 LP  
Wählbar in: Thermische Verfahrenstechnik; Technisches Ergänzungsfach
- Bioprocess Scale-up  
Prof. Dr.-Ing. Alexander Grünberger/ 2 SWS/ 4 LP  
Wählbar in: Technisches Ergänzungsfach
- Biosensors  
Dr. Gözde Kabay/ 2 SWS/ 4 LP  
Wählbar in: Neue Bioproduktionssysteme – Elektrobiotechnologie; Technisches Ergänzungsfach
- C1- Biotechnologie  
Dr. Anke Neumann/ 3 SWS/ 6 LP  
Wählbar in: Neue Bioproduktionssysteme – Elektrobiotechnologie; Technisches Ergänzungsfach
- Computer-Aided Reactor Design  
Prof. Dr.-Ing. Gregor Wehinger/ 3 SWS/ 6 LP  
Wählbar in: Chemische Verfahrenstechnik
- Computer-Assisted Modeling and Control (Seminar und Praktikum)  
Prof. Dr.-Ing. Thomas Meurer/ 2 SWS/ 4 LP; **ab SoSe 25**  
Wählbar in: Automatisierung und Systemverfahrenstechnik; Technisches Ergänzungsfach
- Datengetriebene verfahrenstechnische Modelle in Python  
Dr.-Ing. Frank Rhein/ 3 SWS/ 4 LP  
Wählbar in: Prozesse der Mechanischen Verfahrenstechnik; Biopharmazeutische Verfahrenstechnik;  
Technisches Ergänzungsfach
- Introduction to Numerical Simulation of Reacting Flows  
Prof. Dr. Oliver Stein/ 4 SWS/ 8 LP  
Wählbar in: Technisches Ergänzungsfach
- Kreislaufwirtschaft  
Prof. Dr.-Ing. Dieter Stapf/ 3 SWS/ 6 LP  
Wählbar in: Technisches Ergänzungsfach
- Modellbildung und Simulation in der Thermischen Verfahrenstechnik  
Prof. Dr.-Ing. Tim Zeiner/ 3 SWS/ 6 LP  
Wählbar in: Thermische Verfahrenstechnik
- Paralleles Rechnen  
PD Dr. Mathias J. Krause/ 4 SWS/ 5 LP  
Wählbar in: Prozesse der Mechanischen Verfahrenstechnik; Technisches Ergänzungsfach

### Auslaufende Module

- Instrumentelle Analytik  
Das Modul läuft aus. Lehrveranstaltungen werden nicht mehr angeboten. Prüfungen können in diesem Modul noch bis Ende März 2025 abgelegt werden.

### Änderungen bestehender Module

- Datenanalyse und Statistik  
Das Modul wird vom Wintersemester ins Sommersemester verlegt und findet im SoSe 25 wieder statt.
- Komplexe Phasengleichgewichte  
Titeländerung → Polymerthermodynamik
- Trocknungstechnik – Dünne schichten und poröse Feststoffe  
Das Modul wird vom Wintersemester ins Sommersemester verlegt und findet im SoSe 25 wieder statt.

## 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 Supple- ment Course	2 – 3 elective modules			10
Soft Skills	e. g. offers of the House of Competence			2
	Internship			14
	Master thesis			30

### Recommended course of study

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.

**Start in winter semester**[illegible]

**Start in summer semester**

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						Pr K											
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

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

### 5.1 Master's Thesis

**Credits**  
30

<b>Mandatory</b>		
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"

<b>Mandatory</b>		
M-CIWVT-104374	Process Technology	8 CR
<b>BIW (Election: at least 2 items)</b>		
M-CIWVT-103065	Biopharmaceutical Purification Processes	6 CR
M-CIWVT-104384	Biotechnological Production	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
<b>CIW (Election: at most 2 items)</b>		
M-CIWVT-103058	Thermodynamics III	6 CR
M-CIWVT-103072	Computational Fluid Dynamics	6 CR
M-CIWVT-104377	Thermal Transport Processes <i>First usage possible until Mar 31, 2025.</i>	6 CR
M-CIWVT-104378	Particle Technology	6 CR
M-CIWVT-104383	Kinetics and Catalysis	6 CR
M-CHEMBIO-104486	Physical Chemistry (incl. Lab)	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.



<b>Technical Supplement Course (Election: at least 10 credits)</b>		
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-104263	Food Science and Functionality	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	4 CR
M-CIWVT-104327	Dimensional Analysis of Fluid Mechanic Problems	4 CR
M-CIWVT-104328	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids	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	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	<b>Materials and Processes for Electrochemical Storage</b>	4 CR
M-CIWVT-104354	<b>Refrigeration B - Foundations of Industrial Gas Processing</b>	6 CR
M-CIWVT-104356	<b>Cryogenic Engineering</b>	6 CR
M-CIWVT-104369	<b>Mass Transfer II</b>	6 CR
M-CIWVT-104370	<b>Drying Technology</b>	6 CR
M-CIWVT-104371	<b>Heat Exchangers</b>	4 CR
M-CIWVT-104374	<b>Process Technology</b>	8 CR
M-CIWVT-104377	<b>Thermal Transport Processes</b> <i>First usage possible until Mar 31, 2025.</i>	6 CR
M-CIWVT-104378	<b>Particle Technology</b>	6 CR
M-CIWVT-104383	<b>Kinetics and Catalysis</b>	6 CR
M-CIWVT-104384	<b>Biotechnological Production</b>	6 CR
M-CIWVT-104388	<b>Development of an Innovative Food Product</b>	6 CR
M-CIWVT-104391	<b>Rheology of Disperse Systems</b>	2 CR
M-CIWVT-104395	<b>Microrheology and High Frequency Rheology</b>	2 CR
M-CIWVT-104397	<b>Innovation Management for Products &amp; Processes in the Chemical Industry</b>	4 CR
M-CIWVT-104401	<b>NMR for Engineers</b>	6 CR
M-CIWVT-104422	<b>Processes and Process Chains for Renewable Resources</b>	6 CR
M-CIWVT-104450	<b>Measurement Techniques in Chemical Processing (including practical course)</b>	6 CR
M-CIWVT-104451	<b>Catalytic Micro Reactors</b>	4 CR
M-CIWVT-104452	<b>Surface Effects in Process Engineering</b>	4 CR
M-CIWVT-104461	<b>Chem-Plant</b>	4 CR
M-MACH-100489	<b>BioMEMS - Microsystems Technologies for Life Sciences and Medicine I</b>	4 CR
M-MACH-100490	<b>BioMEMS - Microsystems Technologies for Life Sciences and Medicine II</b>	4 CR
M-MACH-100491	<b>BioMEMS - Microsystems Technologies for Life Sciences and Medicine III</b>	4 CR
M-MACH-102718	<b>Product Development – Methods of Product Engineering</b>	6 CR
M-CIWVT-104560	<b>Instrumental Analytics</b> <i>First usage possible until Mar 31, 2025.</i>	4 CR
M-BGU-103399	<b>Process Engineering in Wastewater Treatment</b>	6 CR
M-CHEMBIO-104486	<b>Physical Chemistry (incl. Lab)</b>	6 CR
M-CIWVT-104478	<b>Vacuum Technology</b>	6 CR
M-CIWVT-104489	<b>Sol-Gel Processes</b>	4 CR
M-CIWVT-104490	<b>Measurement Techniques in Chemical Processing</b>	4 CR
M-CIWVT-104491	<b>Catalytic Micro Reactors (including practical course)</b>	6 CR
M-CIWVT-104570	<b>Biobased Plastics</b>	4 CR
M-MATH-102932	<b>Numerical Methods in Fluid Mechanics</b>	4 CR
M-MACH-102702	<b>Organ Support Systems</b>	4 CR
M-MACH-102720	<b>Principles of Medicine for Engineers</b>	4 CR
M-CHEMBIO-104620	<b>Food Chemistry Basics</b>	4 CR
M-CIWVT-104886	<b>Principles of Ceramic and Powder Metallurgy Processing</b>	4 CR
M-CIWVT-103440	<b>Practical Course in Water Technology</b>	4 CR
M-CIWVT-104973	<b>Digitization in Particle Technology</b>	4 CR
M-CIWVT-105200	<b>Liquid Transportation Fuels</b>	6 CR
M-CIWVT-105205	<b>Microfluidics and Case Studies</b>	6 CR
M-CIWVT-105295	<b>Biotechnological Use of Renewable Resources</b>	4 CR
M-CIWVT-105380	<b>Membrane Technologies in Water Treatment</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105399	<b>Mixing, Stirring, Agglomeration</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105407	<b>Additive Manufacturing for Process Engineering</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105663	<b>Membrane Reactors</b> <i>First usage possible from Apr 01, 2021.</i>	4 CR

M-MATH-103276	<b>Seminar</b> <i>First usage possible from Apr 01, 2021.</i>	3 CR
M-CIWVT-105782	<b>Digital Design in Process Engineering</b> <i>First usage possible from Oct 01, 2021.</i>	6 CR
M-CIWVT-105890	<b>NMR Methods for Product and Process Analysis</b> <i>First usage possible from Apr 01, 2022.</i>	4 CR
M-CIWVT-105891	<b>Power-to-X – Key Technology for the Energy Transition</b> <i>First usage possible from Apr 01, 2022.</i>	6 CR
M-CIWVT-105903	<b>Industrial Wastewater Treatment</b> <i>First usage possible from Apr 01, 2022.</i>	4 CR
M-ETIT-105883	<b>Electrocatalysis</b> <i>First usage possible from Apr 01, 2022.</i>	5 CR
M-CIWVT-105932	<b>Seminar of Food Processing in Practice</b> <i>First usage possible from Apr 01, 2022.</i>	2 CR
M-CIWVT-105933	<b>Introduction to Sensory Analysis</b> <i>First usage possible from Apr 01, 2022.</i>	2 CR
M-ETIT-100532	<b>Batteries and Fuel Cells</b> <i>First usage possible from Oct 01, 2022.</i>	6 CR
M-CIWVT-105993	<b>Innovative Concepts for Formulation and Processing of Printable Materials</b> <i>First usage possible from Oct 01, 2022.</i>	4 CR
M-CIWVT-105996	<b>Extrusion Technology in Food Processing</b> <i>First usage possible from Oct 01, 2022.</i>	4 CR
M-ETIT-105594	<b>Process Analysis: Modeling, Data Mining, Machine Learning</b> <i>First usage possible from Oct 01, 2022.</i>	4 CR
M-BGU-104917	<b>Wastewater Treatment Technologies</b> <i>First usage possible from Oct 01, 2022.</i>	6 CR
M-BGU-106113	<b>Modeling Wastewater Treatment Processes</b> <i>First usage possible from Oct 01, 2022.</i>	6 CR
M-CIWVT-106297	<b>Bioprocess Development</b> <i>First usage possible from Apr 01, 2023.</i>	6 CR
M-CIWVT-106314	<b>Air Pollution Control - Laws, Technology and Application</b> <i>First usage possible from Apr 01, 2023.</i>	4 CR
M-CIWVT-106313	<b>Principles of Constrained Static Optimization</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106316	<b>Nonlinear Process Control</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106317	<b>Optimal and Model Predictive Control</b> <i>First usage possible from Apr 01, 2023.</i>	6 CR
M-CIWVT-106318	<b>Control of Distributed Parameter Systems</b> <i>First usage possible from Apr 01, 2023.</i>	6 CR
M-CIWVT-106319	<b>Data-Based Modeling and Control</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106320	<b>Estimator and Observer Design</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106501	<b>Industrial Bioprocesses</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106507	<b>Fungal Biology and Biotechnology</b> <i>First usage possible from Apr 01, 2023.</i>	4 CR
M-CIWVT-106518	<b>Electrobiotechnology</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106526	<b>Journal Club - Novel Bioproduction Systems</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106529	<b>Membrane Materials &amp; Processes Research Masterclass</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106537	<b>Reactor Modeling with CFD</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106563	<b>Production and Development of Cancer Therapeutics</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106564	<b>Single-Cell Technologies</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106565	<b>Numerical Simulation of Reacting Multiphase Flows</b> <i>First usage possible from Apr 01, 2024.</i>	8 CR
M-CIWVT-106566	<b>Chemical Hydrogen Storage</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR

M-MATH-106634	<b>Computational Fluid Dynamics and Simulation Lab</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106680	<b>Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation</b> <i>First usage possible from Apr 01, 2024.</i>	5 CR
M-CIWVT-106661	<b>Alternative Protein Technologies</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106676	<b>Introduction to Numerical Simulation of Reacting Flows</b> <i>First usage possible from Oct 01, 2024.</i>	8 CR
M-CIWVT-106595	<b>Bioreactor Development</b>	3 CR
M-CIWVT-106698	<b>Process Engineering for the Production of Food from Plant-Based Raw Materials</b>	4 CR
M-CIWVT-106699	<b>Process Engineering for the Production of Food from Animal Origins</b>	4 CR
M-CIWVT-103438	<b>Fundamentals of Water Quality</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR
M-CIWVT-106704	<b>Dynamics of Mechanical and Process Engineering Systems</b> <i>First usage possible from Apr 01, 2024.</i>	6 CR
M-CIWVT-106715	<b>Advanced Methods in Nonlinear Process Control</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106816	<b>C1-Biotechnology</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR
M-CIWVT-106835	<b>Data-Driven Process Engineering Models in Python</b> <i>First usage possible from Oct 01, 2024.</i>	4 CR
M-MATH-101338	<b>Parallel Computing</b> <i>First usage possible from Oct 01, 2024.</i>	5 CR
M-CIWVT-106823	<b>Applied Mass Transfer - Energy Systems and Thin Films</b> <i>First usage possible from Oct 01, 2024.</i>	8 CR
M-CIWVT-106837	<b>Bioprocess Scale-up</b> <i>First usage possible from Oct 01, 2024.</i>	4 CR
M-CIWVT-106838	<b>Biosensors</b> <i>First usage possible from Oct 01, 2024.</i>	4 CR
M-CIWVT-106832	<b>Model Development and Simulation in Thermal Process Engineering</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR
M-CIWVT-106882	<b>Polymer Thermodynamics</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR
M-CIWVT-106881	<b>Circular Economy</b> <i>First usage possible from Oct 01, 2024.</i>	6 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.

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

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

<b>Automation and Process Systems Engineering (Election: at least 16 credits)</b>		
M-CIWVT-106316	<b>Nonlinear Process Control</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106313	<b>Principles of Constrained Static Optimization</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106317	<b>Optimal and Model Predictive Control</b>	6 CR
M-CIWVT-106319	<b>Data-Based Modeling and Control</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106318	<b>Control of Distributed Parameter Systems</b>	6 CR
M-CIWVT-106320	<b>Estimator and Observer Design</b> <i>First usage possible from Oct 01, 2023.</i>	6 CR
M-CIWVT-106704	<b>Dynamics of Mechanical and Process Engineering Systems</b> <i>First usage possible from Apr 01, 2024.</i>	6 CR
M-CIWVT-106715	<b>Advanced Methods in Nonlinear Process Control</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-ETIT-105594	<b>Process Analysis: Modeling, Data Mining, Machine Learning</b>	4 CR
M-CIWVT-104973	<b>Digitization in Particle Technology</b>	4 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

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

<b>Fuel Technology (Election: at least 16 credits)</b>		
M-CIWVT-103069	Combustion Technology	6 CR
M-CIWVT-103075	High Temperature Process Engineering	6 CR
M-CIWVT-104281	Chemical Process Engineering II	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

**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

<b>Chemical Process Engineering (Election: at least 16 credits)</b>		
M-CIWVT-104283	<b>Reaction Kinetics</b>	6 CR
M-CIWVT-104284	<b>Sol-Gel-Processes (Including Practical Course)</b>	6 CR
M-CIWVT-104286	<b>Design of Micro Reactors</b>	6 CR
M-CIWVT-104450	<b>Measurement Techniques in Chemical Processing (including practical course)</b>	6 CR
M-CIWVT-104451	<b>Catalytic Micro Reactors</b>	4 CR
M-CIWVT-104489	<b>Sol-Gel Processes</b>	4 CR
M-CIWVT-104490	<b>Measurement Techniques in Chemical Processing</b>	4 CR
M-CIWVT-104491	<b>Catalytic Micro Reactors (including practical course)</b>	6 CR
M-CIWVT-105663	<b>Membrane Reactors</b> <i>First usage possible from Apr 01, 2021.</i>	4 CR
M-CIWVT-104281	<b>Chemical Process Engineering II</b>	6 CR
M-CIWVT-106537	<b>Reactor Modeling with CFD</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106566	<b>Chemical Hydrogen Storage</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-CIWVT-106809	<b>Computer-Aided Reactor Design</b> <i>First usage possible from Oct 01, 2024.</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

<b>Energy Process Engineering (Election: at least 16 credits)</b>		
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

**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.

<b>Entrepreneurship in Process Engineering (Election: at least 16 credits)</b>		
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

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

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

The following modules can't be combined:

- Process Engineering for the Production of Food from Plant-Based Raw Materials
- Process Engineering for the Production of Food from Animal Origins

<b>Food Process Engineering (Election: at least 16 credits)</b>		
M-CIWVT-103407	<b>Water Technology</b>	6 CR
M-CIWVT-104263	<b>Food Science and Functionality</b>	4 CR
M-CIWVT-104319	<b>Microbiology for Engineers</b>	4 CR
M-CIWVT-104370	<b>Drying Technology</b>	6 CR
M-CHEMBIO-104620	<b>Food Chemistry Basics</b>	4 CR
M-CIWVT-105380	<b>Membrane Technologies in Water Treatment</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105399	<b>Mixing, Stirring, Agglomeration</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105932	<b>Seminar of Food Processing in Practice</b> <i>First usage possible from Apr 01, 2022.</i>	2 CR
M-CIWVT-105933	<b>Introduction to Sensory Analysis</b> <i>First usage possible from Apr 01, 2022.</i>	2 CR
M-CIWVT-105996	<b>Extrusion Technology in Food Processing</b> <i>First usage possible from Oct 01, 2022.</i>	4 CR
M-CIWVT-106661	<b>Alternative Protein Technologies</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106698	<b>Process Engineering for the Production of Food from Plant-Based Raw Materials</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106699	<b>Process Engineering for the Production of Food from Animal Origins</b> <i>First usage possible from Apr 01, 2024.</i>	4 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 the module combination

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".

<b>New Bio-Production Systems - Electro-Biotechnology (Election: at least 16 credits)</b>		
M-CIWVT-106518	<b>Electrobiotechnology</b>	6 CR
M-CIWVT-106816	<b>C1-Biotechnology</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR
M-CIWVT-105295	<b>Biotechnological Use of Renewable Resources</b>	4 CR
M-CIWVT-106526	<b>Journal Club - Novel Bioproduction Systems</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106507	<b>Fungal Biology and Biotechnology</b>	4 CR
M-CIWVT-106678	<b>Industrial Biocatalysis</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106681	<b>Industrial Genetics</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-103441	<b>Biofilm Systems</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-104570	<b>Biobased Plastics</b>	4 CR
M-CIWVT-104273	<b>Commercial Biotechnology</b> <i>First usage possible from Apr 01, 2023.</i>	4 CR
M-ETIT-105883	<b>Electrocatalysis</b> <i>First usage possible from Apr 01, 2023.</i>	5 CR
M-CHEMBIO-106697	<b>Electrochemistry</b> <i>First usage possible from Apr 01, 2024.</i>	3 CR
M-ETIT-100532	<b>Batteries and Fuel Cells</b>	6 CR
M-ETIT-100377	<b>Battery and Fuel Cells Systems</b> <i>First usage possible from Apr 01, 2023.</i>	3 CR
M-ETIT-100508	<b>Modelling and Simulation of Electrochemical Systems</b> <i>First usage possible from Apr 01, 2023.</i>	3 CR
M-CIWVT-106838	<b>Biosensors</b> <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 the module combination

Exceptions:

- The examination in the modules "Selected Formulation Technologies" and "Membrane Technologies in Water Treatment" is a written examination.
- The examination in the module "Commercial Biotechnology" 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

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

<b>Processes for Particle Engineering (Election: at least 16 credits)</b>		
M-CIWVT-103073	<b>Processing of Nanostructured Particles</b>	6 CR
M-CIWVT-104284	<b>Sol-Gel-Processes (Including Practical Course)</b>	6 CR
M-CIWVT-104327	<b>Dimensional Analysis of Fluid Mechanic Problems</b>	4 CR
M-CIWVT-104339	<b>Nanoparticles – Structure and Function</b>	6 CR
M-CIWVT-104340	<b>Gas Particle Separation Processes</b>	6 CR
M-CIWVT-104342	<b>Solid Liquid Separation</b>	8 CR
M-CIWVT-104345	<b>Data Analysis and Statistics</b>	4 CR
M-CIWVT-104350	<b>Microfluidics</b>	4 CR
M-CIWVT-104351	<b>Process Instruments and Machinery and Their Process Integration</b>	4 CR
M-CIWVT-104353	<b>Materials and Processes for Electrochemical Storage</b>	4 CR
M-CIWVT-104401	<b>NMR for Engineers</b>	6 CR
M-MATH-102932	<b>Numerical Methods in Fluid Mechanics</b>	4 CR
M-CIWVT-104560	<b>Instrumental Analytics</b> <i>First usage possible until Mar 31, 2025.</i>	4 CR
M-CIWVT-104489	<b>Sol-Gel Processes</b>	4 CR
M-CIWVT-104337	<b>Gas Particle Measurement Technology</b>	6 CR
M-CIWVT-104973	<b>Digitization in Particle Technology</b>	4 CR
M-CIWVT-105205	<b>Microfluidics and Case Studies</b>	6 CR
M-CIWVT-105399	<b>Mixing, Stirring, Agglomeration</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-MATH-103276	<b>Seminar</b> <i>First usage possible from Apr 01, 2021.</i>	3 CR
M-CIWVT-105890	<b>NMR Methods for Product and Process Analysis</b> <i>First usage possible from Apr 01, 2022.</i>	4 CR
M-CIWVT-106314	<b>Air Pollution Control - Laws, Technology and Application</b> <i>First usage possible from Apr 01, 2023.</i>	4 CR
M-CIWVT-106501	<b>Industrial Bioprocesses</b> <i>First usage possible from Oct 01, 2023.</i>	4 CR
M-MATH-106634	<b>Computational Fluid Dynamics and Simulation Lab</b> <i>First usage possible from Apr 01, 2024.</i>	4 CR
M-CIWVT-106704	<b>Dynamics of Mechanical and Process Engineering Systems</b> <i>First usage possible from Apr 01, 2024.</i>	6 CR
M-CIWVT-106835	<b>Data-Driven Process Engineering Models in Python</b> <i>First usage possible from Oct 01, 2024.</i>	4 CR
M-MATH-101338	<b>Parallel Computing</b> <i>First usage possible from Oct 01, 2024.</i>	5 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.

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

**Election notes**

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

- Thermal Separation Processes II
- 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 Separation Processes II
- 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

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

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

<b>Combustion Technology (Election: at least 16 credits)</b>		
M-CIWVT-103069	<a href="#">Combustion Technology</a>	6 CR
M-CIWVT-103075	<a href="#">High Temperature Process Engineering</a>	6 CR
M-CIWVT-104288	<a href="#">Biomass Based Energy Carriers</a>	6 CR
M-CIWVT-104289	<a href="#">Fuel Technology</a>	6 CR
M-CIWVT-104293	<a href="#">Energy Technology</a>	4 CR
M-CIWVT-104294	<a href="#">Flow and Combustion Instabilities in Technical Burner Systems</a>	4 CR
M-CIWVT-104295	<a href="#">Combustion and Environment</a>	4 CR
M-CIWVT-104296	<a href="#">Hydrogen and Fuel Cell Technologies</a>	4 CR
M-CIWVT-104297	<a href="#">Measurement Techniques in the Thermo-Fluid Dynamics</a>	6 CR
M-CIWVT-105206	<a href="#">Design of a Jet Engine Combustion Chamber</a> <i>First usage possible from Oct 01, 2019.</i>	6 CR
M-CIWVT-104321	<a href="#">Practical Course Combustion Technology</a>	4 CR
M-CIWVT-106565	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a> <i>First usage possible from Apr 01, 2024.</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.

<b>Water Technology (Election: at least 16 credits)</b>		
M-CIWVT-103407	<b>Water Technology</b>	6 CR
M-CIWVT-103441	<b>Biofilm Systems</b>	4 CR
M-CIWVT-104319	<b>Microbiology for Engineers</b>	4 CR
M-CIWVT-104401	<b>NMR for Engineers</b>	6 CR
M-CIWVT-103440	<b>Practical Course in Water Technology</b> <i>First usage possible from Oct 01, 2019.</i>	4 CR
M-CIWVT-104560	<b>Instrumental Analytics</b> <i>First usage possible until Mar 31, 2025.</i>	4 CR
M-CIWVT-105380	<b>Membrane Technologies in Water Treatment</b> <i>First usage possible from Apr 01, 2020.</i>	6 CR
M-CIWVT-105890	<b>NMR Methods for Product and Process Analysis</b> <i>First usage possible from Apr 01, 2022.</i>	4 CR
M-CIWVT-105903	<b>Industrial Wastewater Treatment</b> <i>First usage possible from Apr 01, 2022.</i>	4 CR
M-CIWVT-103438	<b>Fundamentals of Water Quality</b> <i>First usage possible from Oct 01, 2024.</i>	6 CR

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

<b>Mandatory</b>		
M-CIWVT-104527	<b>Internship</b>	14 CR

**5.6 Additional Examinations**

<b>Additional Examinations (Election: at most 30 credits)</b>		
M-CIWVT-104389	<b>Process Development in the Chemical Industry</b>	2 CR
M-FORUM-106753	<b>Supplementary Studies on Science, Technology and Society</b> <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	<a href="#">Model Development and Simulation in Thermal Process Engineering</a>	6 CR	

### 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	<a href="#">Advanced Methods in Nonlinear Process Control</a>	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	<a href="#">Air Pollution Control - Laws, Technology and Application</a>	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	<b>Alternative Protein Technologies</b>	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
- **Lecture period:** Block event: July 29 - August 01
- **Registration:** required by end of May.

### **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	<a href="#">Applied Mass Transfer - Energy Systems and Thin Films</a>	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	<a href="#">Batteries and Fuel Cells</a>	6 CR	Krewer

**Prerequisites**

none

**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	<a href="#">Battery and Fuel Cells Systems</a>	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	<a href="#">Biobased Plastics</a>	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	<a href="#">Biofilm Systems</a>	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	<a href="#">Energy from Biomass</a>	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, CO<sub>2</sub> 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-, CH<sub>4</sub>-, CH<sub>3</sub>OH-, 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	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>	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,  $\mu$ 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 ( $\mu$ 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 &amp; 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	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>	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	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>	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	<a href="#">Biopharmaceutical Purification Processes</a>	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	<a href="#">Bioprocess Development</a>	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 is 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)

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	<a href="#">Bioprocess Scale-up</a>	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	<a href="#">Bioreactor Development</a>	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 winter term	1 term	English	4	1

Mandatory			
T-CIWVT-113714	<a href="#">Biosensors</a>	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)**  
**Technical Supplement Course**

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	<b>Seminar Biotechnological Production</b>	2 CR	Holtmann
T-CIWVT-113831	<b>Biotechnological Production</b>	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	<b>Biotechnological Use of Renewable Resources</b>	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**  
6**Grading scale**  
Grade to a tenth**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

Mandatory			
T-CIWVT-113677	<a href="#">C1-Biotechnology Exam</a>	4 CR	Neumann
T-CIWVT-113678	<a href="#">C1-Biotechnology Presentation</a>	2 CR	Neumann

**M****6.23 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	<a href="#">Catalytic Micro Reactors</a>	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****6.24 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	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>	2 CR	Pfeifer
T-CIWVT-109087	<a href="#">Catalytic Micro Reactors</a>	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****6.25 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	<a href="#">Catalytic Processes in Gas Technologies</a>	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

## 6.26 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	<a href="#">Chemical Hydrogen Storage</a>	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

**6.27 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 / Fuel Technology](#)  
[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	<a href="#">Chemical Process Engineering II</a>	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****6.28 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	<b>Chem-Plant</b>	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****6.29 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	<a href="#">Circular Economy</a>	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****6.30 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	<a href="#">Combustion and Environment</a>	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****6.31 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	<a href="#">Combustion Technology</a>	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****6.32 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****6.33 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	<a href="#">Computational Fluid Dynamics</a>	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****6.34 Module: Computational Fluid Dynamics and Simulation Lab [M-MATH-106634]****Responsible:** PD Dr. Gudrun Thäter**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	<a href="#">Computational Fluid Dynamics and Simulation Lab</a>	4 CR	Krause, 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****6.35 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	4	1

Mandatory			
T-CIWVT-113667	<a href="#">Computer-Aided Reactor Design</a>	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****6.36 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](#)  
[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-CIWVT-108883	<a href="#">Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids</a>	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.

**Workload**

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

## M

**6.37 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	5	1

Mandatory			
T-CIWVT-112826	<a href="#">Control of Distributed Parameter Systems</a>	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****6.38 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	<a href="#">Cryogenic Engineering</a>	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****6.39 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	<a href="#">Data Analysis and Statistics</a>	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****6.40 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	<a href="#">Data-Based Modeling and Control</a>	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****6.41 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	<a href="#">Data-Driven Models in Python - Process Engineering Project</a>	3 CR	Rhein
T-CIWVT-113709	<a href="#">Data-Driven Process Engineering Models in Python - Exam</a>	1 CR	Rhein



**M****6.42 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	<a href="#">Design of a Jet Engine Combustion Chamber</a>	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****6.43 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	<a href="#">Design of Micro Reactors</a>	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****6.44 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](#)

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

Mandatory			
T-CIWVT-108960	<a href="#">Development of an Innovative Food Product</a>	3 CR	van der Schaaf
T-CIWVT-111010	<a href="#">Development of an Innovative Food Product - presentation</a>	3 CR	van der Schaaf

**Competence Certificate**

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**

!! In the winter term 2022/23 the module can unfortunately not be offered !!!

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****6.45 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	<a href="#">Digital Design in Process Engineering - Laboratory</a>	3 CR	Klahn
T-CIWVT-111583	<a href="#">Digital Design in Process Engineering - Oral Examination</a>	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****6.46 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	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German	4	1

Mandatory			
T-CIWVT-110111	<a href="#">Digitization in Particle Technology</a>	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****6.47 Module: Dimensional Analysis of Fluid Mechanic Problems [M-CIWVT-104327]**

**Responsible:** Dr.-Ing. Bernhard Hochstein  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [Technical Supplement Course](#)  
[Specialized Course I / Applied Rheology](#)  
[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-108882	<a href="#">Dimensional Analysis of Fluid Mechanic Problems</a>	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.

**Workload**

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

**M****6.48 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	<a href="#">Drying Technology</a>	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****6.49 Module: Dynamics of Mechanical and Process Engineering Systems [M-CIWVT-106704]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)[Specialized Course I / Mechanical Process Engineering](#) (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
6	Grade to a tenth	Each summer term	1 term	German	4	1

Mandatory			
T-CIWVT-113485	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Prerequisite</a>	3 CR	Jerono
T-CIWVT-113486	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Exam</a>	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.



**M****6.50 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	<a href="#">Electrobiotechnology</a>	4 CR	Holtmann
T-CIWVT-113829	<a href="#">Electrobiotechnology Seminar</a>	2 CR	Holtmann

## M

## 6.51 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	<a href="#">Electrocatalysis</a>	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****6.52 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	<a href="#">Electrochemistry</a>	3 CR	
------------------	----------------------------------	------	--

**Prerequisites**

None

**M****6.53 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	<a href="#">Energy Technology</a>	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****6.54 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	<a href="#">Environmental Biotechnology</a>	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****6.55 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	<a href="#">Estimator and Observer Design</a>	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****6.56 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	<a href="#">Extrusion Technology in Food Processing</a>	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****6.57 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	<a href="#">Flow and Combustion Instabilities in Technical Burner Systems</a>	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****6.58 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	<a href="#">Fluid Mechanics of Non-Newtonian Fluids</a>	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****6.59 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	<a href="#">Fluidized Bed Technology</a>	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](http://dx.doi.org/10.1002/14356007.b04_239.pub2)

**M****6.60 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	<a href="#">Food Chemistry Basics</a>	4 CR	Bunzel

**Prerequisites**

None

**Workload**

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

**M****6.61 Module: Food Science and Functionality [M-CIWVT-104263]**

**Responsible:** Dr. Stephanie Seifert  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [Technical Supplement Course](#)  
[Specialized Course I / Food 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-108801	<a href="#">Food Science and Functionality</a>	4 CR	Seifert

**Competence Certificate**

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

**Prerequisites**

None

**Competence Goal**

Students should be enabled to evaluate the health-promoting properties of foods and diets based on their nutrient content.

**Content**

Relevance of nutrition for human health and well-being. Focus will be on macro- and micronutrients (carbohydrates, proteins, lipids, vitamins, minerals, trace elements, dietary fiber, and phytochemicals) and on their structural and metabolic functions. Major food groups (plant-/animal-based) as sources of essential nutrients will be introduced. In addition, functional aspects of foods/food constituents (e. g. cholesterol-lowering, immunostimulatory; reduction of disease risk) will be presented.

**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****6.62 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	<a href="#">Formulation of (Bio)pharmaceutical Therapeutics</a>	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****6.63 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	<a href="#">Fuel Technology</a>	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

**6.64 Module: Fundamentals of Water Quality [M-CIWWT-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-CIWWT-106838	<a href="#">Fundamentals of Water Quality</a>	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****6.65 Module: Fungal Biology and Biotechnology [M-CIWVT-106507]****Responsible:** PD Dr.-Ing. Katrin Ochsenreither**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2023)  
[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	2

Mandatory			
T-CIWVT-113125	<a href="#">Fungal Biology Biotechnology Seminar</a>	2 CR	Ochsenreither
T-CIWVT-113150	<a href="#">Fungal Biology Biotechnology</a>	2 CR	Ochsenreither

**Competence Certificate**

The learning control consists of two partial achievements:

- Examination of another type: Presentation
- Oral examination, duration approx. 20 minutes

**Prerequisites**

Participation in the oral examination is only possible after successful participation in the seminar.

**Competence Goal**

Students are able to explain basic aspects of fungal cell biology, microbiology and molecular genetics and apply them on biotechnological processes and enzyme production with fungi.

**Content**

- Introduction to fungal phylogeny and characteristics of selected groups
- Characteristics and morphology of filamentous fungi and yeasts
- Growth patterns and proliferation
- Molecular biology of fungi
- Principles and examples of biotechnological processes of fungi
- Pathogenic fungi
- Food production with fungi
- Biomass degradation mechanisms

**Module grade calculation**

Module grade is the LP-wighted mean of the two partial achievements.

**Workload**

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

**Literature**

- Lehrbuch Fungi: Biology and Applications, Third Edition, Wiley (elektronisch verfügbar).
- Selected articles



**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	<a href="#">Gas Particle Measurement Technology</a>	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	<a href="#">Gas Particle Separation Processes</a>	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	<a href="#">Heat Exchangers</a>	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	<a href="#">Heat Transfer II</a>	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	<a href="#">High Temperature Process Engineering</a>	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	<a href="#">Hydrogen and Fuel Cell Technologies</a>	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: 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	<a href="#">Industrial Aspects in Bioprocess Technology</a>	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****6.73 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	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German	4	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

**6.74 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****6.75 Module: Industrial Genetics [M-CIWVT-106681]****Responsible:** PD Dr.-Ing. Katrin Ochsenreither**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	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each summer term	1 term	German	4	1

Mandatory			
T-CIWVT-113434	<a href="#">Industrial Genetics</a>	4 CR	Ochsenreither

**Competence Certificate**

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

**Prerequisites**

None

**Competence Goal**

Students will be able to explain and describe the basic methods of genetic engineering mentioned above, such as methods of DNA recombination, sequencing and PCR; manipulation of gene expression in prokaryotes; production of heterologous proteins in prokaryotic and eukaryotic hosts; targeted mutagenesis and protein design; and metabolic engineering. The methods can be applied to similar problems and proposed solutions can be developed.

**Content**

Fundamentals of genetic engineering with respect to its industrial applicability; methods of DNA recombination, sequencing and PCR; manipulation of gene expression in prokaryotes; production of heterologous proteins in prokaryotic and eukaryotic hosts; targeted mutagenesis and protein design; genetically modified microorganisms in industry; production of pharmaceutically active proteins such as e.g. Insulin or interferon, antibiotic production, molecular diagnostics, production of antibodies, vaccines and therapeutics; metabolic engineering - optimization of substance production by genetic engineering methods.

**Module grade calculation**

The module grade is the grade of the oral exam.

**Workload**

- Lectures: 30 hrs
- Self-Study: 30 h
- Exam preparation: 60 h

## M

**6.76 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	<a href="#">Industrial Wastewater Treatment</a>	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****6.77 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	<a href="#">Innovation Management for Products &amp; Processes in the Chemical Industry</a>	4 CR	Neumann

**Competence Certificate**

Learning control is a written examination (multiple choice) lasting approx. 30 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****6.78 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	<a href="#">Innovative Concepts for Formulation and Processing of Printable Materials</a>	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****6.79 Module: Instrumental Analytics [M-CIWVT-104560]****Responsible:** apl. Prof. Dr. Gisela Guthausen**Organisation:** KIT Department of Chemical and Process Engineering

**Part of:** [Technical Supplement Course](#) (Usage until 3/31/2025)  
[Specialized Course I / Water Technology](#) (Usage until 3/31/2025)  
[Specialized Course I / Mechanical Process Engineering](#) (Usage until 3/31/2025)

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-106837	<a href="#">Instrumental Analytics</a>	4 CR	Guthausen

**Competence Certificate**

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

**Prerequisites**

None

**Competence Goal**

The students are familiar with the important methods of modern instrumental analytics and their range of application. They can explain and critically compare the underlying physical principles of the methods. Students are able to develop solution concepts for analytical problems and to choose adequate methods to answer a specific question.

**Content**

Introduction to selected methods of modern instrumental analysis, as for example optical methods and magnetic resonance methods. Imaging techniques such as MRI,  $\mu$ CT and optical microscopy (CLSM and OCT) and fundamentals of data and image analysis are presented. The focus is on a clear presentation of the physico-chemical fundamentals and the underlying principles as well as the fields of application.

**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

**Literature**

References are given in the respective context 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	Grading scale	Recurrence	Duration	Language	Level	Version
14	pass/fail	Each term	1 term	German	4	1

Mandatory			
T-CIWVT-109276	<a href="#">Internship</a>	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)

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	<a href="#">Introduction to Numerical Simulation of Reacting Flows - Prerequisite</a>	6 CR	Stein
T-CIWVT-113436	<a href="#">Introduction to Numerical Simulation of Reacting Flows</a>	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**

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 is 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	Grading scale	Recurrence	Duration	Language	Level	Version
2	Grade to a tenth	Each summer term	1 term	German	4	1

Mandatory			
T-CIWVT-109128	<a href="#">Introduction to Sensory Analysis with Practice</a>	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	<a href="#">Journal Club - Novel Bioproduction Systems</a>	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	<a href="#">Kinetics and Catalysis</a>	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**

- Skript (<https://ilias.studium.kit.edu>);
- 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	<a href="#">Liquid Transportation Fuels</a>	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, CO<sub>2</sub> 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, H<sub>2</sub> 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	<a href="#">Mass Transfer II</a>	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, diffusion distillation, mixture condensation, physical and chemical absorption (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	<a href="#">Materials and Processes for Electrochemical Storage</a>	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	<a href="#">Measurement Techniques in Chemical Processing</a>	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	<a href="#">Measurement Techniques in Chemical Processing</a>	4 CR	Müller
T-CIWVT-109181	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>	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	<a href="#">Measurement Techniques in the Thermo-Fluid Dynamics</a>	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	<b>Membrane Materials &amp; Processes Research Masterclass</b>	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 ist 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 Reactors [M-CIWVT-105663]****Responsible:** Prof. Dr.-Ing. Peter Pfeifer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2021)  
[Specialized Course I / Chemical Process Engineering](#) (Usage from 4/1/2021)**Credits**  
4**Grading scale**  
Grade to a tenth**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
5**Version**  
1

Mandatory			
T-CIWVT-111314	<a href="#">Membrane Reactors</a>	4 CR	Pfeifer

**Competence Certificate**

Learning control is an oral examination with a duration of about 20 minutes (SPO section 4, subsection 2 No. 2).

**Prerequisites**

None

**Module grade calculation**

The grade of module ist the grade of oral examination.

**Annotation**

The module is not offered in summer semester 23 and summer semester 24. Examinations for persons who have already attended the lecture are possible by arrangement.

**Workload**

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

**M****6.93 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	<a href="#">Exercises: Membrane Technologies</a>	1 CR	Horn, Saravia
T-CIWVT-113236	<a href="#">Membrane Technologies in Water Treatment</a>	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: applied membrane processes in waste water disposal and drinking water supply.

**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****6.94 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	<a href="#">Microbiology for Engineers</a>	4 CR	Schwartz

**Prerequisites**

None

**Workload**

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

**M****6.95 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	<a href="#">Microfluidics</a>	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****6.96 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	<a href="#">Microfluidics</a>	4 CR	Leneweit
T-CIWVT-110549	<a href="#">Microfluidics - Case Studies</a>	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****6.97 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	<a href="#">Microrheology and High Frequency Rheology</a>	2 CR	Oelschlaeger

**Prerequisites**

None

**Workload**

- Attendance time (Lecture): 15 h
- Homework: 35 h
- Exam Preparation: 10 h

**M****6.98 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	<a href="#">Mixing, Stirring, Agglomeration</a>	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****6.99 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	<a href="#">Modeling Wastewater Treatment Processes</a>	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****6.100 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	<a href="#">Modelling and Simulation of Electrochemical Systems</a>	3 CR	Weber

**Prerequisites**

none



**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	<a href="#">Master's Thesis</a>	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: 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	<a href="#">Nanoparticles – Structure and Function</a>	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****6.103 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	<a href="#">NMR for Engineers</a>	4 CR	Guthausen
T-CIWVT-109144	<a href="#">Laboratory Work for NMR for Engineers</a>	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****6.104 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	<a href="#">NMR Methods for Product and Process Analysis</a>	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****6.105 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	<a href="#">Nonlinear Process Control</a>	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.



## 6.106 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	<a href="#">Numerical Methods in Fluid Mechanics</a>	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****6.107 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:** [Technical Supplement Course](#) (Usage from 4/1/2024)  
[Specialized Course I / Combustion Technology](#) (Usage from 4/1/2024)

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	<a href="#">Numerical Simulation of Reacting Multiphase Flows - Prerequisite</a>	6 CR	Stein
T-CIWVT-113233	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a>	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.

**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****6.108 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	<a href="#">Optimal and Model Predictive Control</a>	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****6.109 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	1

Mandatory			
T-MACH-105228	Organ Support Systems	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 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

6.110 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	Grading scale	Recurrence	Duration	Level	Version
5	Grade to a tenth	Irregular	1 term	5	1

Mandatory			
T-MATH-102271	Parallel Computing	5 CR	Krause, Wieners

Prerequisites

None

**M****6.111 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	<a href="#">Particle Technology Exam</a>	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****6.112 Module: Physical Chemistry (incl. Lab) [M-CHEMBIO-104486]**

**Responsible:** Dr. Tomas Kubar  
Dr. Benno Meier

**Organisation:** KIT Department of Chemistry and Biosciences

**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	2

Mandatory			
T-CHEMBIO-109178	<a href="#">Physical Chemistry (Written Exam)</a>	4 CR	Kubar, Meier
T-CHEMBIO-109179	<a href="#">Physical Chemistry (Lab)</a>	2 CR	Kubar, Meier

**Competence Certificate**

The examination consists of two Parts:

1. written examination with a duration of 60 minutes (section 4 subsection 2 number 1 SPO)
2. practical course, ungraded study achievement (§ 4 Abs. 3 SPO)

**Prerequisites**

None

**Competence Goal**

V+Ü: Students understand the main basics of quantum mechanics which are necessary for the application of spectroscopic methods. They can understand and apply selected spectroscopic methods for the evaluation, analysis and solution of problems in engineering sciences.

They understand the thermodynamic formalism for the description of interfacial phenomena. They are able to analyze wetting and dewetting problems, nucleation phenomena as well as ad- and desorption within this formalism.

They can understand and analyze electrochemical cells within thermodynamics of heterogeneous systems with charged particles. They understand transport phenomena of charged particles in solutions. They can apply the Debye-Hückel-Theory to thermodynamic and transport phenomena. Using these knowledges they are able to acquire and understand more complex electrochemical systems like batteries, fuel cells and corrosion processes.

P: Within the practical course they work on selected projects. Beginning with preparing working steps, over the experimental procedure, to the evaluation of the received data and the written presentation they deepen their knowledge in the field of selected experimental examples. They are able to interpret the results with respect to scientific significance and accuracy.

**Content**

V+Ü: description of fundamentals and application of physico-chemical subjects relevant for chemical engineering sciences:

Basics of quantum mechanics and its application to spectroscopy, FTIR-absorption spectroscopy, UV-VIS spectroscopy, Raman spectroscopy, NMR spectroscopy;

Thermodynamics of interfaces, Gibbs' adsorption isotherm, adsorption at solid surfaces, Langmuir- and BET adsorption, nucleation theory;

Electrochemistry, thermodynamics of heterogeneous systems with charged particles, electrochemical cells, Debye-Hückel theory, ionic migration in an electric field, technical application of electrochemistry;

P: performance of selected experiments in the field of physical chemistry, improvement of theoretical knowledge focusing on selected topics.

**Workload**

Attendance time (V+Ü): 3 SWS; 45 h

Homework (V+Ü): 45 h

Exam Preparation: 30 h

Practical Course (4 times): 16 h

Practical Course (pre- and postprocessing) : 44 h

**Literature**

1. W. Atkins, J. de Paula, Physikalische Chemie (aktuelle Ausgabe), Wiley-VCH, Weinheim;
2. Wedler, Lehrbuch der Physikalischen Chemie (aktuelle Ausgabe), Wiley-VCH, Weinheim;

Begleitend zu Vorlesung und Übung wird ein kompaktes Skriptum zur Verfügung gestellt.

**M****6.113 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	<a href="#">Physical Foundations of Cryogenics</a>	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****6.114 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	5	1

Mandatory			
T-CIWVT-113796	<a href="#">Polymer Thermodynamics</a>	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.

**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****6.115 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	<b>Power-to-X – Key Technology for the Energy Transition</b>	4 CR	Dittmeyer, Holtappels
T-CIWVT-111842	<b>Practical in Power-to-X: Key Technology for the Energy Transition</b>	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](https://www.kopernikus-projekte.de/aktuelles/news/p2x_roadmap_3_0))

**M****6.116 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	<a href="#">Practical Course Combustion Technology</a>	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****6.117 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	<a href="#">Practical Course in Water Technology</a>	3 CR	Hille-Reichel, Horn
T-CIWWT-110866	<a href="#">Excursions: Water Supply</a>	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****6.118 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	<a href="#">Principles of Ceramic and Powder Metallurgy Processing</a>	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****6.119 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	<a href="#">Principles of Constrained Static Optimization</a>	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****6.120 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****6.121 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	<a href="#">Process Analysis: Modeling, Data Mining, Machine Learning</a>	4 CR	Borchert, Heizmann

**Prerequisites**

none

**Module grade calculation**

Die Modulnote ist die Note der mündlichen Prüfung.

**M****6.122 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	<a href="#">Process and Plant Safety</a>	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****6.123 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	<a href="#">Process Development in the Chemical Industry</a>	2 CR	Dahlhaus

**Prerequisites**

None

**M****6.124 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	<a href="#">Process Engineering for the Production of Food from Animal Origins</a>	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****6.125 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	<a href="#">Process Engineering for the Production of Food from Plant-Based Raw Materials</a>	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****6.126 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	<a href="#">Process Engineering in Wastewater Treatment</a>	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.; Chericaro, 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****6.127 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	<a href="#">Process Instruments and Machinery and Their Process Integration</a>	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****6.128 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	<a href="#">Process Modeling in Downstream Processing</a>	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****6.129 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	<a href="#">Practical Course Process Technology and Plant Design</a>	0 CR	Scheiff
T-CIWVT-106149	<a href="#">Initial Exam Process Technology and Plant Design</a>	0 CR	Scheiff
T-CIWVT-106150	<a href="#">Process Technology and Plant Design Written Exam</a>	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****6.130 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 term	1 term	German	4	1

Mandatory			
T-CIWVT-108997	<a href="#">Processes and Process Chains for Renewable Resources</a>	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****6.131 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	<a href="#">Processing of Nanostructured Particles</a>	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****6.132 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	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each summer term	1 term	German/English	4	2

Mandatory			
T-MACH-109192	Methods and Processes of PGE - Product Generation Engineering	6 CR	Albers, Burkardt, Matthiesen

**Competence Certificate**

Written examination (processing time: 120 min + 10 min reading time)

**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****6.133 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	<a href="#">Production and Development of Cancer Therapeutics</a>	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 ist 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

**6.134 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**  
6**Grading scale**  
Grade to a tenth**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
5**Version**  
1

Mandatory			
T-CIWVT-108821	<a href="#">Reaction Kinetics</a>	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****6.135 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	<a href="#">Reactor Modeling with CFD</a>	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**

- Wehinger: Skript zur Lehrveranstaltung
- Ferziger, Perić: Numerische Strömungsmechanik; 2020 ; Springer
- Versteeg, Malalasekera; An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd Edition); 2007; Pearson

**M****6.136 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	<a href="#">Refinery Technology - Liquid Fuels</a>	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****6.137 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	<a href="#">Refrigeration B - Foundations of Industrial Gas Processing</a>	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 H<sub>2</sub>-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****6.138 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	<a href="#">Rheology and Processing of Disperse Systems</a>	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****6.139 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](#)  
[Specialized Course I / Applied Rheology](#)

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	<a href="#">Rheology and Processing of Polymers</a>	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.

**Workload**

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

**M****6.140 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](#)  
[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-108881	<a href="#">Rheology and Rheometry</a>	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.

**Workload**

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

**M****6.141 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	<a href="#">Rheology of Complex Fluids and Advanced Rheometry</a>	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****6.142 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	<a href="#">Rheology of Disperse Systems</a>	2 CR	Willenbacher

**Prerequisites**

None

**Workload**

- Attendance time (Lecture): 15h
- Homework: 35 h
- Exam Preparation: 10 h



**M****6.143 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	<a href="#">Rheology of Polymers</a>	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



## 6.144 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	Grading scale	Recurrence	Duration	Language	Level	Version
3	pass/fail	Each term	1 term	German	5	1

Mandatory			
T-MATH-106541	<a href="#">Seminar Mathematics</a>	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****6.145 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	<a href="#">Seminar of Food Processing in Practice with Excursion</a>	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****6.146 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 technologie
- 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****6.147 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	<a href="#">Sol-Gel Processes</a>	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****6.148 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	<a href="#">Sol-Gel Processes</a>	4 CR	Müller
T-CIWVT-108823	<a href="#">Practical Course Sol-Gel Processes</a>	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****6.149 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	<a href="#">Solid Liquid Separation</a>	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****6.150 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	<a href="#">Stability of Disperse Systems</a>	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****6.151 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	4	3

Mandatory			
T-CIWVT-106098	<a href="#">Statistical Thermodynamics</a>	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.

**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****6.152 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	<a href="#">Entrepreneurship</a>	3 CR	Terzidis
T-WIWI-110166	<a href="#">SIL Entrepreneurship Project</a>	3 CR	Terzidis
Innovation Project (Election: 6 credits)			
T-CIWVT-112201	<a href="#">Innovation Project Porous Ceramics from the 3D Printer</a>	6 CR	Willenbacher
T-CIWVT-113226	<a href="#">Innovation Project Electronic Devices from Printable Conductive Materials</a>	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****6.153 Module: Supplementary Studies on Science, Technology and Society [M-FORUM-106753]**

**Responsible:** Dr. Christine Mielke  
Christine Myglas

**Organisation:**

**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.zak.kit.edu/english/16495.php>. 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@zak.kit.edu](mailto:stg@zak.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!

<b>Mandatory</b>			
T-FORUM-113578	<a href="#">Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration</a>	2 CR	Mielke, Myglas
T-FORUM-113579	<a href="#">Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration</a>	2 CR	Mielke, Myglas
<b>Advanced Unit Supplementary Studies on Science, Technology and Society (Election: at least 12 credits)</b>			
T-FORUM-113580	<a href="#">Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration</a>	3 CR	Mielke, Myglas
T-FORUM-113581	<a href="#">Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration</a>	3 CR	Mielke, Myglas
T-FORUM-113582	<a href="#">Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration</a>	3 CR	Mielke, Myglas
<b>Mandatory</b>			
T-FORUM-113587	<a href="#">Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society</a>	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.zak.kit.edu/begleitstudium-wtg>.

**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 Advanced Module is divided into 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.

**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.

Additional credit points (supplementary achievements), up to a maximum of 12, can be earned from interdisciplinary achievements and can be included in the supplementary course. Upon request, these supplementary achievements are listed in the certificate of the accompanying course, marked as such, and recorded with their grades as specified in paragraph 9. However, these supplementary achievements are **not** included in the calculation of the overall grade for the accompanying course.

The statutes for the accompanying study programme Science, Technology and Society apply.

**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****6.154 Module: Surface Effects in Process Engineering [M-CIWVT-104452]**

**Responsible:** Ioannis Nicolaou  
**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	German	4	1

Mandatory			
T-CIWVT-109088	<a href="#">Surface Effects in Process Engineering</a>	4 CR	Nicolaou

**Competence Certificate**

Learning control is an oral examination with a duration of about 30 minutes.

**Prerequisites**

None

**Competence Goal**

A deep understanding of the physico-chemical effects at the surface of the dispersed phase in dispersions and the consideration of their interaction with the dispersity degree as precondition for understanding and optimizing processes involving dispersions.

**Content**

Definitions, Applications and stability of dispersions; Molecular – kinetic properties of dispersions: Thermal molecular motion and Brownian motion, Diffusion in solutions and dispersions, sedimentation stability; Adsorption at solid-gas interface: Nature of adsorption forces, Langmuir monomolecular adsorption theory, polymolecular theory of Polanyi and BET-theory, capillary condensation, chemical adsorption, kinetic of adsorption, influence of the properties of adsorbent and adsorptive on adsorption; Adsorption at solution-gas interface: Surface tension, surface active and inactive substances, Adsorption equation of Gibbs, Shishkovsky-equation and the derivation of Langmuir-equation, effects of the structure and size of tenside molecules, structure of the adsorbed layer; Adsorption at solid-solution interface: Molecular adsorption from the solution, ionic adsorption, wetting phenomena; Electrical properties of dispersions, Introduction to electrokinetic phenomena, structure of the electric double layer (Theories of Helmholtz – Perrin, Gouy-Chapman and Stern), Effects of electrolytes on zeta-potential, Electrophoresis and Electroosmosis, Measurement of zeta-potential; Stability and Coagulation of dispersions: Kinetic of coagulation, interparticle energy potential, solvation, structural-mechanical and entropy effects, coagulation through electrolytes, adsorption phenomena and coagulation; Applications in Crystallization and Solid – Liquid Separation.

**Module grade calculation**

The module grade is the grade of the oral examination.

**Annotation**

A deep understanding of the physico-chemical effects at the surface of the dispersed phase in dispersions and the consideration of their interaction with the dispersity degree as precondition for understanding and optimizing processes involving dispersions.

**Workload**

Lectures and Exercises: 30 h

Homework: 60 h

Exam preparation: 30 h

**M****6.155 Module: Thermal Transport Processes [M-CIWVT-104377]**

**Responsible:** Prof. Dr.-Ing. Thomas Wetzel  
Prof. Dr.-Ing. Tim Zeiner

**Organisation:** KIT Department of Chemical and Process Engineering

**Part of:** [Advanced Fundamentals \(CIW\)](#) (Usage until 3/31/2025)  
[Technical Supplement Course](#) (Usage until 3/31/2025)

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

Mandatory			
T-CIWVT-106034	<a href="#">Thermal Transport Processes</a>	6 CR	Wetzel, Zeiner

**Competence Certificate**

Learning control is a written examination lasting 180 minutes.

**Prerequisites**

None

**Competence Goal**

Students can systematically apply scientific methods for physics-based modelling of Thermal Transport Processes and of selected unit operations. To this end they are able to create mathematical models and systems of equations for process simulation. Furthermore, they have some know-how to use numerical tools for solving these quite large systems of equations. Finally, students are skilled in the quantitative application of the taught knowledge to new and yet unknown processes and engineering problems.

**Content**

Fundamentals of process simulation with specific regard to Thermal Transport Processes. Advanced Heat and Mass Transfer (boiling, condensation, multi-component mass transport).

**Module grade calculation**

The module grade is the grade of the written exam.

**Annotation**

The module expires and will be replaced by the module Thermal Process Engineering II in the summer semester 2025.

**Workload**

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

**Literature**

- comprehensive manuscript (for download)
- pertinent list of literature for self-studying

**M****6.156 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	<a href="#">Thermodynamics III</a>	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****6.157 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**  
4

**Grading scale**  
Grade to a tenth

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

Mandatory			
T-CIWVT-106100	<a href="#">Thermodynamics of Interfaces</a>	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.

**M****6.158 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	<a href="#">Vacuum Technology</a>	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****6.159 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	<b>Wastewater Treatment Technologies</b>	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****6.160 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	<b>Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation</b>	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****6.161 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	<a href="#">Water Technology</a>	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 &amp; 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]

**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	<a href="#">Model Development and Simulation in Thermal Process Engineering</a>	3 SWS	Project (P /  )	Zeiner

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

#### Prerequisites

None.

## 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 2024	2241020	<a href="#">Additive Manufacturing for Process Engineering</a>	2 SWS	Lecture / 	Klahn
Exams					
ST 2024	7293103	<a href="#">Additive Manufacturing for Process Engineering - Examination</a>			Klahn
WT 24/25	7241020	<a href="#">Additive Manufacturing for Process Engineering - Examination</a>			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 2024	2243035	<a href="#">Advanced Methods in Nonlinear Control</a>	2 SWS	Lecture / 	Meurer, Jerono
Exams					
ST 2024	7243035	<a href="#">Advanced Methods in Nonlinear Process Control</a>			Meurer, Jerono
WT 24/25	7243035	<a href="#">Advanced Methods in Nonlinear Process Control</a>			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 2024	2244040	<a href="#">Clean Air - Laws, Technology and Application</a>	2 SWS	Lecture / 	Dittler
Exams					
ST 2024	7292993	<a href="#">Air Pollution Control - Laws, Technology and Application</a>			Dittler
WT 24/25	7292993	<a href="#">Air Pollution Control - Laws, Technology and Application</a>			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 2024	2211330	<a href="#">Alternative Protein Technologies</a>	2 SWS	Block / 🗓️	Emin
Exams					
ST 2024	7211330	<a href="#">Alternative Protein Technologies</a>	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	<a href="#">Applied Mass Transfer – Energy Systems and Thin Films</a>	2 SWS	Lecture / 	Schabel, Scharfer, und Mitarbeitende
WT 24/25	2260231	<a href="#">Exercises on 2260230 Applied Mass Transfer – Energy Systems and Thin Films</a>	2 SWS	Practice / 	Schabel, Scharfer, und Mitarbeitende
Exams					
WT 24/25	7260230	<a href="#">Applied Mass Transfer - Energy Systems and Thin Films</a>	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:**

**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					
ST 2024	7300006	Batteries and Fuel Cells			Krewer
WT 24/25	7304207	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 2024	2304214	<a href="#">Batterie- und Brennstoffzellensysteme</a>	2 SWS	Lecture / 	Weber
Exams					
ST 2024	7304214	<a href="#">Batteries and Fuel Cells Systems</a>			Weber
WT 24/25	7304214	<a href="#">Batteries and Fuel Cells Systems</a>			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	<a href="#">Biobased Plastic</a>	2 SWS	Lecture / 	Kindervater, Syldatk, Schmiedl
Exams					
ST 2024	7212820-VT-BK	<a href="#">Biobased Plastics</a>			Kindervater
WT 24/25	7212820-VT-BK	<a href="#">Biobased Plastics</a>			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 2024	2233820	<a href="#">Biofilm Systems</a>	2 SWS	Lecture / 	Hille-Reichel, Wagner
Exams					
ST 2024	7232617	<a href="#">Biofilm Systems</a>			Horn, Hille-Reichel, Wagner
WT 24/25	7232617	<a href="#">Biofilm Systems</a>			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	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100966	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>			Guber
WT 24/25	76-T-MACH-100966	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</a>			Guber

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

### Competence Certificate

written exam (75 Min.)

### Prerequisites

none

## 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 2024	2142883	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100967	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>			Guber
WT 24/25	76-T-MACH-100967	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</a>			Guber

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

### Competence Certificate

Written exam (75 Min.)

### Prerequisites

none

## 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 2024	2142879	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>	2 SWS	Lecture / 	Guber, Ahrens
Exams					
ST 2024	76-T-MACH-100968	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>			Guber
WT 24/25	76-T-MACH-100968	<a href="#">BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</a>			Guber

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

### Competence Certificate

Written exam (75 Min.)



### Prerequisites





none

## 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	<a href="#">Biopharmaceutical Purification Processes</a>	3 SWS	Lecture / 	Hubbuch, Franzreb
WT 24/25	2214011	<a href="#">Exercises on 2214010 Biopharmaceutical Purification Processes</a>	1 SWS	Practice / 	Hubbuch, Franzreb
Exams					
ST 2024	7223011	<a href="#">Biopharmaceutical Purification Processes</a>			Hubbuch
WT 24/25	7223011	<a href="#">Biopharmaceutical Purification Processes</a>			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 2024	2213020	<a href="#">Bioprocess Development</a>	2 SWS	Lecture / 	Grünberger
ST 2024	2213021	<a href="#">Bioprocess Development - Exercises</a>	2 SWS	Practice / 	Grünberger
Exams					
ST 2024	7222001	<a href="#">Bioprocess Development</a>			Grünberger
WT 24/25	7222001	<a href="#">Bioprocess Development</a>			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	<a href="#">Bioprocess Scale-Up</a>	2 SWS	Lecture / 	Grünberger
Exams					
WT 24/25	7213040	<a href="#">Bioprocess Scale-up</a>	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	Credits	Grading scale	Version
Completed coursework	3	pass/fail	1

Events					
ST 2024	2210020	<a href="#">Team Project "99€ Bioreactor": Development of an Innovative Bioreactor Concept</a>	2 SWS	Project (P /  )	Grünberger, Holtmann
Exams					
ST 2024	7210020-BRE	<a href="#">Bioreactor Development</a>			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

**Version**  
1

Events					
WT 24/25	2214810	<a href="#">Biosensors</a>	2 SWS	Lecture / 	Kabay
Exams					
WT 24/25	7214810	<a href="#">Biosensors</a>			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 summer term	1

Exams			
WT 24/25	7212020-V-BS	<a href="#">Biotechnological Production</a>	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	<a href="#">Biotechnological Use of Renewable Resources</a>	2 SWS	Lecture / 	Syldatk
Exams					
ST 2024	7212210-VT-BR	<a href="#">Biotechnology in Bioeconomy</a>			Syldatk
WT 24/25	7212210-VT-BR	<a href="#">Biotechnological Use of Renewable Resources</a>			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	<a href="#">C1-Biotechnology</a>	2 SWS	Lecture / 	Neumann
WT 24/25	2212131	<a href="#">Exercises on 2212130 C1-Biotechnology</a>	1 SWS	Practice / 	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**  
 Examination of another type

**Credits**  
 2

**Grading scale**  
 Grade to a third

**Version**  
 1

Events					
WT 24/25	2212130	<a href="#">C1-Biotechnology</a>	2 SWS	Lecture / 	Neumann
WT 24/25	2212131	<a href="#">Exercises on 2212130 C1-Biotechnology</a>	1 SWS	Practice / 	Neumann




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







## T

## 7.24 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					
ST 2024	2220210	<a href="#">Katalytische Mikroreaktoren</a>	2 SWS	Lecture / 	Pfeifer
ST 2024	2220211	<a href="#">Praktikum zu 2220210 Katalytische Mikroreaktoren</a>	1 SWS	Practical course / 	Pfeifer, und Mitarbeitende
WT 24/25	2220211	<a href="#">Practical Course for 2220210 Catalytic Micro Reactors</a>	1 SWS	Practical course / 	Pfeifer, Dittmeyer, und Mitarbeitende
Exams					
ST 2024	7210211	<a href="#">Catalytic Micro Reactors</a>	Pfeifer		
WT 24/25	7210211	<a href="#">Catalytic Micro Reactors</a>	Pfeifer		

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

## 7.25 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 2024	2231520	<a href="#">Catalytic Processes in Gas Technologies</a>	2 SWS	Lecture / 	Bajohr
Exams					
ST 2024	7230017	<a href="#">Catalytic Processes in Gas Technologies</a>			Bajohr
WT 24/25	7230017	<a href="#">Catalytic Processes in Gas Technologies</a>			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

## 7.26 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	<a href="#">Chemical Hydrogen Storage</a>	2 SWS	Lecture / 	Wolf, Sauer
Exams					
ST 2024	7231420	<a href="#">Chemical Hydrogen Storage</a>	Wolf		
WT 24/25	7231420	<a href="#">Chemical Hydrogen Storage</a>	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

## 7.27 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	<a href="#">Chemical Process Engineering II</a>	2 SWS	Lecture / 	Wehinger
WT 24/25	2220021	<a href="#">Exercises on 2220020 Chemical Process Engineering II</a>	1 SWS	Practice / 	Wehinger
Exams					
ST 2024	7210104	<a href="#">Chemical Process Engineering II</a>	Wehinger		
WT 24/25	7210104	<a href="#">Chemical Process Engineering II</a>	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

## 7.28 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			
ST 2024	7200101	<a href="#">Chem-Plant</a>	Enders
WT 24/25	7200101	<a href="#">Chem-Plant</a>	Enders

**Prerequisites**

None

**Recommendation**

Thermodynamics III, Process Technology

## T

## 7.29 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	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each winter term	1

**Competence Certificate**

The learning control is an oral examination on lectures, exercises and case studies, duration approx. 30 minutes.

**Prerequisites**

None.

## T

## 7.30 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 2024	2232020	<a href="#">Combustion and Environment</a>	2 SWS	Lecture / 	Trimis
Exams					
ST 2024	7231203	<a href="#">Combustion and Environment</a>	Trimis		
WT 24/25	7231203	<a href="#">Combustion and Environment</a>	Trimis		

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

**Prerequisites**

None

## T

## 7.31 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	<a href="#">Fundamentals of Combustion Technology</a>	2 SWS	Lecture / 	Trimis
WT 24/25	2232011	<a href="#">Exercises for 2232010 Fundamentals of Combustion Technology</a>	1 SWS	Practice / 	Trimis, und Mitarbeitende
Exams					
ST 2024	7231201	<a href="#">Combustion Technology</a>	Trimis		
WT 24/25	7231201	<a href="#">Combustion Technology</a>	Trimis		

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

**Prerequisites**

None



## T

## 7.32 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 2024	2212810	<a href="#">Commercial Biotechnology</a>	2 SWS	Lecture / 	Kindervater, und Mitarbeitende
Exams					
ST 2024	7212810-VT-KB	<a href="#">Commercial Biotechnology</a>	Kindervater		
WT 24/25	7212810-VT-KB	<a href="#">Commercial Biotechnology</a>	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

## 7.33 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	<a href="#">Computational Fluid Dynamics</a>	2 SWS	Lecture / 	Nirschl, und Mitarbeitende
WT 24/25	2245021	<a href="#">Exercises for 2245020 Computational Fluid Dynamics</a>	1 SWS	Practice / 	Nirschl, und Mitarbeitende
Exams					
ST 2024	7291932	<a href="#">Computational Fluid Dynamics</a>	Nirschl		
WT 24/25	7291020	<a href="#">Computational Fluid Dynamics</a>	Nirschl		

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

**Competence Certificate**

Learning control is a written examination lasting 90 minutes.

**Prerequisites**

None

## T

**7.34 Course: Computational Fluid Dynamics and Simulation Lab [T-MATH-113373]**

**Responsible:** PD Dr. Mathias Krause  
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 2024	0161700	<a href="#">Computational Fluid Dynamics and Simulation Lab</a>	4 SWS	Practical course	Thäter, Krause, Simonis
Exams					
ST 2024	7700108	<a href="#">Computational Fluid Dynamics and Simulation Lab</a>			Thäter

**Prerequisites**

none

## T

## 7.35 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	<a href="#">Computer-Aided Reactor Design</a>	1 SWS	Lecture / 	Wehinger
Exams					
WT 24/25	7220070	<a href="#">Computer-Aided Reactor Design</a>	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

## 7.36 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**  
Oral examination





**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

Events					
WT 24/25	2242250	<a href="#">Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids</a>	2 SWS	Lecture / 	Hochstein
Exams					
ST 2024	7290202	<a href="#">Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids</a>			Hochstein
WT 24/25	7290202	<a href="#">Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids</a>			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

**7.37 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 2024	2243040	<a href="#">Control of Distributed Parameter Systems</a>	3 SWS	Block / 	Meurer
Exams					
ST 2024	7243040	<a href="#">Control of Distributed Parameter Systems</a>			Meurer
WT 24/25	7250002	<a href="#">Control of Distributed Parameter Systems</a>			Meurer

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

## T

## 7.38 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	<a href="#">Cryogenic Engineering</a>	2 SWS	Lecture / 	Grohmann
WT 24/25	2250141	<a href="#">Cryogenic Engineering - Exercises</a>	1 SWS	Practice / 	Grohmann
Exams					
ST 2024	7200201	<a href="#">Cryogenic Engineering</a>	Grohmann		
WT 24/25	7250140	<a href="#">Cryogenic Engineering</a>	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

## 7.39 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

Exams			
ST 2024	7291120	<a href="#">Data Analysis and Statistics</a>	Guthausen
WT 24/25	7291120	<a href="#">Data Analysis and Statistics</a>	Guthausen

**Competence Certificate**

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

**Prerequisites**

None



## T

## 7.40 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	<a href="#">Data-Based Modeling and Control</a>	3 SWS	Lecture / Practice ( / 🎧)	Meurer
Exams					
ST 2024	7243070	<a href="#">Data-Based Modeling and Control</a>			Meurer
WT 24/25	7200009	<a href="#">Data-Based Modeling and Control</a>			Meurer

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

**T****7.41 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	<a href="#">Data-Driven Modeling with Python</a>	2 SWS	Lecture / 	Rhein
WT 24/25	2245321	<a href="#">Project Work on 2245320 Data-Driven Modeling with Python</a>	1 SWS	Practice / 	Rhein
Exams					
WT 24/25	7291320	<a href="#">Data-Driven Modeling with Python - Project</a>			Rhein

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

**T****7.42 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	<a href="#">Data-Driven Process Engineering Models in Python - Exam</a>	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

**7.43 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	<a href="#">Design of a Jet Engine Combustion Chamber</a>	2 SWS	/ 	Harth
Exams					
ST 2024	7232310	<a href="#">Design of a Gas Turbine Combustor</a>			Harth
WT 24/25	7232310	<a href="#">Design of a Jet Engine Combustion Chamber</a>			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

## 7.44 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	<a href="#">Design of Micro Reactors</a>	4 SWS	Lecture / Practice ( / ●)	Pfeifer
Exams					
ST 2024	7210210	<a href="#">Design of Micro Reactors</a>	Pfeifer		
WT 24/25	7210210	<a href="#">Design of Micro Reactors</a>	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

## 7.45 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 2024	2211220	<a href="#">Teamprojekt "Eco TROPHELIA": Entwicklung eines innovativen Lebensmittels</a>	3 SWS	Project (P / 🗣️)	van der Schaaf, Höhne, Schochat, und Mitarbeitende
Exams					
ST 2024	7220022	<a href="#">Development of an Innovative Food Product - presentation</a>			van der Schaaf
WT 24/25	7220022	<a href="#">Development of an Innovative Food Product</a>			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****7.46 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 2024	2211220	<a href="#">Teamprojekt "Eco TROPHELIA": Entwicklung eines innovativen Lebensmittels</a>	3 SWS	Project (P /  )	van der Schaaf, Höhne, Schochat, und Mitarbeitende
Exams					
ST 2024	7220025	<a href="#">Development of an Innovative Food Product</a>			van der Schaaf
WT 24/25	7220025	<a href="#">Development of an Innovative Food Product</a>			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****7.47 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	<a href="#">Practical Course Digital Design in Process Engineering</a>	2 SWS	Practical course / 	Klahn, Jayavelu
Exams					
WT 24/25	7293100	<a href="#">Digital Design in Process Engineering - Laboratory</a>			Klahn

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

**Competence Certificate**

Laboratory, ungraded.

**Prerequisites**

None.



## T

**7.48 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	<a href="#">Digital Design in Process Engineering</a>	2 SWS	Lecture / 	Klahn
Exams					
ST 2024	7293101	<a href="#">Digital Design in Process Engineering - Oral Examination</a>			Klahn
WT 24/25	7293101	<a href="#">Digital Design in Process Engineering - Oral Examination</a>			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

## 7.49 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	<a href="#">Digitization in Particle Technology</a>	2 SWS	Lecture / 	Gleiß, und Mitarbeitende
Exams					
ST 2024	7291922	<a href="#">Digitization in particle technology</a>			Gleiß
WT 24/25	7291922	<a href="#">Digitization in Particle Technology</a>			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****7.50 Course: Dimensional Analysis of Fluid Mechanic 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 Mechanic Problems](#)**Type**  
Oral examination**Credits**  
4**Grading scale**  
Grade to a third**Recurrence**  
Each summer term**Version**  
1

Events					
ST 2024	2242230	<a href="#">Dimensional Analysis of Fluid Mechanic Problems</a>	2 SWS	Lecture / 	Hochstein
Exams					
ST 2024	7290201	<a href="#">Dimensional Analysis of Fluid Mechanic Problems</a>			Hochstein
WT 24/25	7290201	<a href="#">Dimensional Analysis of Fluid Mechanic Problems</a>			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

## 7.51 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	<a href="#">Drying Technology</a>	2 SWS	Lecture / ✕	Schabel
WT 24/25	2260211	<a href="#">Exercises for 2260210 Drying Technology</a>	1 SWS	Practice / ✕	Schabel, und Mitarbeitende
Exams					
ST 2024	7260210	<a href="#">Drying Technology</a>			Schabel
WT 24/25	7280022	<a href="#">Drying Technology</a>			Schabel

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****7.52 Course: Dynamics of Mechanical and Process Engineering Systems - Exam [T-CIWVT-113486]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106704 - Dynamics of Mechanical and Process Engineering Systems](#)**Type**  
Oral examination**Credits**  
3**Grading scale**  
Grade to a third**Recurrence**  
Each summer term**Version**  
1

Events					
ST 2024	2243120	<a href="#">Dynamics of Mechanical and Process Engineering Systems</a>	2 SWS	Lecture / 	Jerono, Meurer
ST 2024	2243121	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Exercises</a>	1 SWS	Practice / 	Jerono
Exams					
ST 2024	7243120	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Exam</a>	Jerono		
WT 24/25	7243120	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Exam</a>	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



## 7.53 Course: Dynamics of Mechanical and Process Engineering Systems - Prerequisite [T-CIWVT-113485]





**Responsible:** Dr.-Ing. Pascal Jerono

**Organisation:** KIT Department of Chemical and Process Engineering

**Part of:** [M-CIWVT-106704 - Dynamics of Mechanical and Process Engineering Systems](#)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each summer term	1

Events					
ST 2024	2243120	<a href="#">Dynamics of Mechanical and Process Engineering Systems</a>	2 SWS	Lecture / 	Jerono, Meurer
ST 2024	2243121	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Exercises</a>	1 SWS	Practice / 	Jerono
Exams					
ST 2024	7243121	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Prerequisite</a>			Jerono
WT 24/25	7243121	<a href="#">Dynamics of Mechanical and Process Engineering Systems - Prerequisite</a>			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****7.54 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:****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****7.55 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:****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****7.56 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:****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: 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	<a href="#">Electrobiotechnology</a>	2 SWS	Lecture / 	Holtmann
WT 24/25	2212011	<a href="#">Electrobiotechnology - Exercises</a>	1 SWS	Seminar / 	Holtmann
Exams					
ST 2024	7212010-VT-EBT	<a href="#">Electrobiotechnology</a>	Holtmann		
WT 24/25	7212010-VT-EBT	<a href="#">Electrobiotechnology</a>	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

## 7.58 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	2212900	<a href="#">Electrobiotechnology Seminar</a>	2 SWS	Seminar / 	Holtmann, und Mitarbeitende
Exams					
WT 24/25	7212011-S-EBT	<a href="#">Electrobiotechnology Seminar</a>	Holtmann		

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



## 7.59 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**  
Written examination

**Credits**  
6

**Grading scale**  
Grade to a third

**Version**  
2

Events					
ST 2024	2304300	<a href="#">Electrocatalysis</a>	3 SWS	Lecture /	Röse
ST 2024	2304301	<a href="#">Exercise to 2304300 Electrocatalysis</a>	1 SWS	Practice /	Röse
Exams					
ST 2024	7300021	<a href="#">Electrocatalysis</a>			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.

**T****7.60 Course: Electrochemistry [T-CHEMBIO-109773]****Organisation:** KIT Department of Chemistry and Biosciences**Part of:** [M-CHEMBIO-106697 - Electrochemistry](#)**Type**  
Written examination**Credits**  
3**Grading scale**  
Grade to a third**Recurrence**  
Irregular**Version**  
1

Exams			
ST 2024	7100101EC	<a href="#">Electrochemistry</a>	Schuster, Passerini
ST 2024	7100101EC_2	<a href="#">Electrochemistry</a>	Schuster, Nattland

**Prerequisites**

none

## T

## 7.61 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	<a href="#">Biomass Based Energy Carriers</a>	2 SWS	Lecture / 	Bajohr
WT 24/25	2231511	<a href="#">Exercises on 2231510 Biomass Based Energy Carriers</a>	1 SWS	Practice / 	Bajohr, und Mitarbeitende
Exams					
ST 2024	7230016	<a href="#">Energy from Biomass</a>			Bajohr
WT 24/25	7230016	<a href="#">Energy from Biomass</a>			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

## 7.62 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	<a href="#">Energy Technology I</a>	2 SWS	Lecture / 	Büchner
Exams					
ST 2024	7231501	<a href="#">Energy Technology</a>			Büchner
WT 24/25	7231501	<a href="#">Energy Technology</a>			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

## 7.63 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					
ST 2024	2545001	<a href="#">Entrepreneurship</a>	2 SWS	Lecture / 	Terzidis, Dang
WT 24/25	2545001	<a href="#">Entrepreneurship</a>	2 SWS	Lecture / 	Terzidis, Dang
Exams					
ST 2024	7900002	<a href="#">Entrepreneurship</a>			Terzidis
ST 2024	7900192	<a href="#">Entrepreneurship</a>			Terzidis
WT 24/25	7900045	<a href="#">Entrepreneurship</a>			Terzidis
WT 24/25	7900229	<a href="#">Entrepreneurship</a>			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

**7.64 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	<a href="#">Environmental Biotechnology</a>	2 SWS	Lecture / 	Tiehm
Exams					
ST 2024	7232614	<a href="#">Environmental Biotechnology</a>	Tiehm		
WT 24/25	7232614	<a href="#">Environmental Biotechnology</a>	Tiehm		

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

**Prerequisites**

None

## T

## 7.65 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	<a href="#">Estimator and Observer Design</a>	3 SWS	Lecture / Practice ( / ●)	Jerono
Exams					
ST 2024	7243110	<a href="#">Estimator and Observer Design</a>			Jerono
WT 24/25	7200007	<a href="#">Estimator and Observer Design</a>			Jerono

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

## T


## 7.66 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 2024	2233011	<a href="#">Membrane Technologies in Water Treatment - Exercises</a>	1 SWS	Practice / 	Horn, Saravia, und Mitarbeitende
Exams					
ST 2024	7233011	<a href="#">Exercises for Membrane Technologies</a>			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

**7.67 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	<a href="#">Excursions: Water Supply</a>	Horn, Hille-Reichel

## T

**7.68 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	<a href="#">Extrusion Technology in Food Processing</a>	2 SWS	Lecture / 	Emin
Exams					
ST 2024	7211310	<a href="#">Extrusion Technology in Food Processing</a>			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

## 7.69 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 2024	2232820	<a href="#">Flow and Combustion Instabilities in Technical Burner Systems</a>	2 SWS	/ 	Büchner
Exams					
ST 2024	7231502	<a href="#">Flow and Combustion Instabilities in Technical Burner Systems</a>			Büchner
WT 24/25	7231502	<a href="#">Flow and Combustion Instabilities in Technical Burner Systems</a>			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

**7.70 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					
ST 2024	2242230	<a href="#">Dimensional Analysis of Fluid Mechanic Problems</a>	2 SWS	Lecture / 	Hochstein
WT 24/25	2242250	<a href="#">Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids</a>	2 SWS	Lecture / 	Hochstein
Exams					
ST 2024	7290204	<a href="#">Fluid Mechanics of Non-Newtonian Fluids</a>			Hochstein
WT 24/25	7290204	<a href="#">Fluid Mechanics of Non-Newtonian Fluids</a>			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

**7.71 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 2024	2231110	<a href="#">Fluidized Bed Technology</a>	2 SWS	Lecture / 	Rauch
Exams					
ST 2024	7230012	<a href="#">Fluidized Bed Technology</a>			Rauch
WT 24/25	7230012	<a href="#">Fluidized Bed Technology</a>			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

## 7.72 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 2024	6601	<a href="#">Grundlagen der Lebensmittelchemie I</a>	2 SWS	Lecture / 	Bunzel
Exams					
ST 2024	71109442	<a href="#">Food Chemistry Basics</a>			Bunzel
WT 24/25	71109442	<a href="#">Food Chemistry Basics</a>			Bunzel

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

**Prerequisites**

None

## T

## 7.73 Course: Food Science and Functionality [T-CIWVT-108801]

**Responsible:** Dr. Stephanie Seifert  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-104263 - Food Science and Functionality](#)

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

Events					
WT 24/25	2211810	<a href="#">Food Science and Functionality</a>	2 SWS	Lecture / ✕	Seifert
Exams					
ST 2024	7211810	<a href="#">Food Science and Functionality</a>	Watzl		
WT 24/25	7211810	<a href="#">Food Science and Functionality</a>	Seifert		

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

**Competence Certificate**


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





**Prerequisites**

None

## T

**7.74 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	<a href="#">Formulation of (Bio)pharmaceutical Therapeutics</a>	2 SWS	Lecture / 	Hubbuch
Exams					
ST 2024	7223012	<a href="#">Formulation of (Bio)pharmaceutical Therapeutics</a>			Hubbuch
WT 24/25	7223012	<a href="#">Formulation of (Bio)pharmaceutical Therapeutics</a>			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

## 7.75 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	<a href="#">Fuel Technology</a>	2 SWS	Lecture / 	Scheiff
WT 24/25	2231021	<a href="#">Exercises on 2231020 Fuel Technology</a>	1 SWS	Practice / 	Scheiff, und Mitarbeitende
Exams					
ST 2024	7230013	<a href="#">Fuel Technology</a>			Kolb
WT 24/25	7230013	<a href="#">Fuel Technology</a>			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

## 7.76 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	<a href="#">Fundamentals of Water Quality</a>	2 SWS	Lecture / 	Wagner
WT 24/25	2233231	<a href="#">Fundamentals of Water Quality - Exercises</a>	1 SWS	Practice / 	Wagner, und Mitarbeitende
Exams					
ST 2024	7232625	<a href="#">Fundamentals of Water Quality</a>	Abbt-Braun		
WT 24/25	7232625	<a href="#">Fundamentals of Water Quality</a>	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

**7.77 Course: Fungal Biology Biotechnology [T-CIWVT-113150]**

**Responsible:** PD Dr.-Ing. Katrin Ochsenreither  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-106507 - Fungal Biology and Biotechnology](#)


**Type**  
Oral examination





**Credits**  
2

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

Events					
WT 24/25	2212250	<a href="#">Fungal Biology and Biotechnology</a>	2 SWS	Seminar / 	Ochsenreither
Exams					
ST 2024	7212250-VT-BBP	<a href="#">Fungal Biology Biotechnology</a>	Ochsenreither		
WT 24/25	7212250-VT-BBP	<a href="#">Fungal Biology Biotechnology</a>	Ochsenreither		

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

**Competence Certificate**

Oral examination, duration approx. 20 minutes.

**Prerequisites**

Seminar talk

**Modeled Conditions**


The following conditions have to be fulfilled:





1. The course [T-CIWVT-113125 - Fungal Biology Biotechnology Seminar](#) must have been passed.

**T****7.78 Course: Fungal Biology Biotechnology Seminar [T-CIWVT-113125]**

**Responsible:** PD Dr.-Ing. Katrin Ochsenreither  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-106507 - Fungal Biology and Biotechnology](#)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each winter term	2

Events					
WT 24/25	2212250	<a href="#">Fungal Biology and Biotechnology</a>	2 SWS	Seminar / 	Ochsenreither
Exams					
WT 24/25	7212251-S-BBP	<a href="#">Fungal Biology Biotechnology Seminar</a>	Ochsenreither		

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

**Competence Certificate**

Examination of another type: Seminar talk.

## T

## 7.79 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	<a href="#">Gas Particle Measurement Technology</a>	2 SWS	Lecture / 	Dittler
WT 24/25	2244021	<a href="#">Exercises on 2244020 Gas Particle Measurement Technology</a>	1 SWS	Practice / 	Dittler, und Mitarbeitende
Exams					
ST 2024	7292918	<a href="#">Gas Particle Measurement Technology</a>			Dittler
WT 24/25	7292918	<a href="#">Gas Particle Measurement Technology</a>			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

**7.80 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	<a href="#">Gas Particle Separation Processes</a>	2 SWS	Lecture / 	Meyer
WT 24/25	2244121	<a href="#">Exercises on 2244120 Gas Particle Separation Processes</a>	1 SWS	Practice / 	Meyer
Exams					
ST 2024	7292939	<a href="#">Gas Particle Separation Processes</a>			Meyer
WT 24/25	7292939	<a href="#">Gas Particle Separation Processes</a>			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

## 7.81 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	<a href="#">Heat Exchangers</a>	2 SWS	Lecture / 	Wetzel
Exams					
ST 2024	7260010	<a href="#">Heat Exchangers</a>			Wetzel
WT 24/25	7280032	<a href="#">Heat Exchangers</a>			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

## 7.82 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	<a href="#">Heat Transfer II</a>	2 SWS	Lecture / 	Wetzel, Dietrich
WT 24/25	2260021	<a href="#">Exercises on 2260020 Heat Transfer II</a>	1 SWS	Practice / 	Wetzel, Dietrich
Exams					
ST 2024	7260020	<a href="#">Heat Transfer II</a>			Wetzel
WT 24/25	7280031	<a href="#">Heat Transfer II</a>			Wetzel





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

## T

## 7.83 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 2024	2232210	<a href="#">High Temperature Process Engineering</a>	2 SWS	Lecture / 	Stapf
ST 2024	2232211	<a href="#">High Temperature Process Engineering - Exercises</a>	1 SWS	Practice / 	Stapf, und Mitarbeitende
Exams					
ST 2024	7231001	<a href="#">High Temperature Process Engineering</a>			Stapf
WT 24/25	7231001	<a href="#">High Temperature Process Engineering</a>			Stapf

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

None

## T

## 7.84 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 2024	2232030	<a href="#">Hydrogen and Fuel Cell Technologies</a>	2 SWS	Lecture / 	Trimis
Exams					
ST 2024	7231204	<a href="#">Hydrogen and Fuel Cell Technologies</a>			Trimis
WT 24/25	7231204	<a href="#">Hydrogen and Fuel Cell Technologies</a>			Trimis
WT 24/25	7231204-2	<a href="#">Hydrogen and Fuel Cell Technologies</a>			Trimis

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

**Prerequisites**

None

## T

**7.85 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 2024	2214020	<a href="#">Industrial Aspects in Bioprocess Technology</a>	2 SWS	Lecture / 	Hubbuch
Exams					
ST 2024	7223016	<a href="#">Industrial Aspects in Bioprocess Technology</a>			Hubbuch
WT 24/25	7223016	<a href="#">Industrial Aspects in Bioprocess Technology</a>			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

## 7.86 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 winter term

**Version**  
1

Events					
ST 2024	2212230	<a href="#">Industrial Biocatalysis</a>	2 SWS	Lecture / 	Rudat
Exams					
ST 2024	7212230-VT-IBK	<a href="#">Industrial Biocatalysis</a>	Rudat		
WT 24/25	7212230_VT-IBK	<a href="#">Industrial Biocatalysis</a>	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

**7.87 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	<a href="#">Industrial Bioprocesses</a>	2 SWS	Lecture / 	Kopf
Exams					
ST 2024	7291933	<a href="#">Industrial bioprocesses</a>	Kopf		
WT 24/25	7245810	<a href="#">Industrial bioprocesses</a>	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

## 7.88 Course: Industrial Genetics [T-CIWVT-113434]

**Responsible:** PD Dr.-Ing. Katrin Ochsenreither  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-106681 - Industrial Genetics](#)


**Type**  
Oral examination





**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

Events					
ST 2024	2212120	<a href="#">Industrial Genetics</a>	2 SWS	Lecture / 	Ochsenreither
Exams					
ST 2024	7212121-VT-IG	<a href="#">Industrial Genetics</a>	Neumann, Ochsenreither		

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

**Prerequisites**


None





## T

## 7.89 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 2024	2233020	<a href="#">Industrial Wastewater Treatment</a>	2 SWS	Lecture / 	Horn
Exams					
ST 2024	7232007	<a href="#">Industrial Wastewater Treatment</a>	Horn		
WT 24/25	7232007	<a href="#">Industrial Wastewater Treatment</a>	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

**7.90 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	<a href="#">Process Technology and Plant Design I</a>	2 SWS	Lecture / 	Scheiff, Bajohr
WT 24/25	2231012	<a href="#">Practical Course Process Technology and Plant Design</a>	1 SWS	Practical course / 	Scheiff, und Mitarbeitende
Exams					
WT 24/25	7230100				Scheiff
WT 24/25	7230100-2	<a href="#">Initial Exam Process Technology and Plant Design</a>			Scheiff

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

**Competence Certificate**

Completed coursework; ungraded exam

**Prerequisites**

None

## T


## 7.91 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	<a href="#">Innovation Management for Products and Processes in the Chemical Industry - Announcement</a>	2 SWS	Block / 	Sauer, Neumann
Exams					
ST 2024	7231330	<a href="#">Innovation Management for Products &amp; Processes in the Chemical Industry</a>			Neumann
WT 24/25	7200028	<a href="#">Innovation Management for Products &amp; Processes in the Chemical Industry</a>			Neumann

Legend:  Online,  Blended (On-Site/Online),  On-Site, X 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****7.92 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	<a href="#">Innovation Project Electronic Devices from Printable Conductive Materials</a>	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****7.93 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	<a href="#">Innovation Project Porous Ceramics from the 3D Printer</a>	2 SWS	Project (P /  )	Willenbacher
Exams					
ST 2024	7242061	<a href="#">Innovation Project Porous Ceramics from the 3D Printer</a>			Willenbacher

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


**Prerequisites**





None.

## T

**7.94 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	<a href="#">Innovative Concepts for Formulation and Processing of Printable Materials</a>	2 SWS	Lecture / 	Willenbacher
Exams					
WT 24/25	7290108	<a href="#">Innovative Concepts for Formulation and Processing of Printable Materials</a>			Willenbacher

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

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

**Prerequisites**

None



## 7.95 Course: Instrumental Analytics [T-CIWVT-106837]

**Responsible:** apl. Prof. Dr. Gisela Guthausen  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-104560 - Instrumental Analytics](#)

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
2

Events					
ST 2024	2245110	<a href="#">Instrumental Analytics</a>	2 SWS	Lecture /	Guthausen
Exams					
ST 2024	7291942	<a href="#">Instrumental Analysis</a>			Guthausen
WT 24/25	7291942	<a href="#">Instrumental Analytics</a>			Guthausen

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

### Competence Certificate

Oral exam, about 30 min

### Prerequisites

None



## T

**7.96 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			
ST 2024	7200000	<a href="#">Internship</a>	Bajohr
WT 24/25	7200000	<a href="#">Internship</a>	Bajohr

**Prerequisites**

None

**T****7.97 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**  
Oral examination

**Credits**  
2

**Grading scale**  
Grade to a third

**Version**  
1

Events					
WT 24/25	2232130	<a href="#">Introduction to Numerical Simulation of Reacting Flows</a>	2 SWS	Lecture / 	Stein
WT 24/25	2232131	<a href="#">Introduction to Numerical Simulation of Reacting Flows - Exercises</a>	2 SWS	Practice / 	Stein

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

**Competence Certificate**

The learning control is 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**

## 7.98 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	6	pass/fail	1

Events					
WT 24/25	2232130	<a href="#">Introduction to Numerical Simulation of Reacting Flows</a>	2 SWS	Lecture / 	Stein
WT 24/25	2232131	<a href="#">Introduction to Numerical Simulation of Reacting Flows - Exercises</a>	2 SWS	Practice / 	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

**7.99 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 2024	6630	<a href="#">Einführung in die Sensorik mit Übungen</a>	1 SWS	Lecture / 	Stemler
Exams					
ST 2024	7220016	<a href="#">Introduction to Sensory Analysis with Practice</a>			Scherf
WT 24/25	7220016	<a href="#">Introduction to Sensory Analysis with Practice</a>			


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





**Prerequisites**

None

**T****7.100 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 2024	2212040	<a href="#">Journal Club – Novel Bioproduction Systems</a>	2 SWS	Seminar / 	Holtmann
Exams					
ST 2024	7212040-VT-JC	<a href="#">Journal Club - Novel Bioproduction Systems</a>	Holtmann		

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

None.

## T

## 7.101 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 2024	2220030	<a href="#">Kinetics and Catalysis</a>	2 SWS	Lecture / 	Wehinger
ST 2024	2220031	<a href="#">Kinetics and Catalysis - Exercises</a>	1 SWS	Practice / 	Wehinger, und Mitarbeitende
Exams					
ST 2024	7210102	<a href="#">Kinetics and Catalysis</a>			Wehinger
WT 24/25	7210102	<a href="#">Kinetics and Catalysis</a>			Wehinger

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

### Competence Certificate

Learning control is a written examination lasting 60 minutes.

### Prerequisites



None





## T

## 7.102 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	<a href="#">NMR for Engineers</a>	2 SWS	Lecture / 	Guthausen
WT 24/25	2245131	<a href="#">Laboratory Work for 2245130 NMR for Engineers</a>	2 SWS	Practical course / 	Guthausen
Exams					
WT 24/25	7291955	<a href="#">Laboratory Work for NMR for Engineers</a>			Guthausen

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

**Prerequisites**

None

**T****7.103 Course: Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113578]****Responsible:** Dr. Christine Mielke  
Christine Myglas**Organisation:****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.



## T

## 7.104 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	<a href="#">Liquid Transportation Fuels</a>	2 SWS	Lecture / 	Rauch
WT 24/25	2231131	<a href="#">Exercises on 2231130 Liquid Transportation Fuels</a>	1 SWS	Practice / 	Rauch
Exams					
ST 2024	7230020	<a href="#">Liquid Transportation Fuels</a>			Rauch
WT 24/25	7230010	<a href="#">Liquid Transportation Fuels</a>			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

## 7.105 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	<a href="#">Mass Transfer II</a>	2 SWS	Lecture / 	Dietrich
WT 24/25	2260321	<a href="#">Exercises for 2260320 Mass Transfer II</a>	1 SWS	Practice / 	Dietrich, und Mitarbeitende
Exams					
ST 2024	7260220	<a href="#">Mass Transfer II</a>			Schabel
WT 24/25	7280021	<a href="#">Mass Transfer II</a>			Schabel

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

**7.106 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****7.107 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 2024	2245840	<a href="#">Materials and Processes for Electrochemical Storage</a>	2 SWS	Lecture / 	Tübke
Exams					
ST 2024	7245840	<a href="#">Materials and Processes for Electrochemical Storage</a>			Tübke
WT 24/25	7291840	<a href="#">Materials for Electrochemical Storage</a>			Tübke

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

None

## T

## 7.108 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 2024	2220330	<a href="#">Messmethoden in der Chemischen Verfahrenstechnik</a>	2 SWS	Lecture / 	Müller
ST 2024	2220331	<a href="#">Praktikum zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik</a>	1 SWS	Practical course / 	Müller
Exams					
ST 2024	7210107	<a href="#">Measurement Techniques in Chemical Processing</a>			Müller
WT 24/25	7210107	<a href="#">Measurement Techniques in Chemical Processing</a>			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

**7.109 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	<a href="#">Diagnostics in Thermal Fluid Dynamics</a>	2 SWS	Lecture / 	Trimis
WT 24/25	2232041	<a href="#">Exercises for 2232040 Diagnostics in Thermal Fluid Dynamics</a>	1 SWS	Practice / 	Trimis
Exams					
ST 2024	7231202	<a href="#">Measurement Techniques in the Thermo-Fluid Dynamics</a>			Trimis
WT 24/25	7231202	<a href="#">Measurement Techniques in the Thermo-Fluid Dynamics</a>			Trimis

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

None

**T****7.110 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	<a href="#">Membrane Materials &amp; Processes Research Masterclass</a>	4 SWS	Lecture / Practice ( / ●)	Schäfer
Exams					
WT 24/25	7233120	<a href="#">Membrane Materials &amp; Processes Research Masterclass</a>			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

## 7.111 Course: Membrane Reactors [T-CIWVT-111314]

**Responsible:** Prof. Dr.-Ing. Peter Pfeifer  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-105663 - Membrane Reactors](#)

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Version**  
1

Events					
ST 2024	2220230	<a href="#">Membrane Reactors</a>	2 SWS	Lecture / ✕	Pfeifer
Exams					
ST 2024	7210213	<a href="#">Membrane Reactors</a>			Pfeifer
WT 24/25	7210213	<a href="#">Membrane Reactors</a>			Pfeifer

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

**Competence Certificate**

Learning control is an oral examination with a duration of about 20 minutes (SPO section 4, subsection 2 No. 2).

**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	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	1

Events					
ST 2024	2233010	<a href="#">Membrane Technologies in Water Treatment</a>	2 SWS	Lecture / 	Horn, Saravia
ST 2024	2233011	<a href="#">Membrane Technologies in Water Treatment - Exercises</a>	1 SWS	Practice / 	Horn, Saravia, und Mitarbeitende
Exams					
ST 2024	7233010	<a href="#">Membrane Technologies in Water Treatment</a>			Horn, Saravia
WT 24/25	7232605	<a href="#">Membrane Technologies in Water Treatment</a>			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 2024	2146176	<a href="#">Methods and Processes of PGE – Product Generation Engineering</a>	4 SWS	Lecture / 	Albers, Düser
Exams					
ST 2024	76-T-MACH-105382	<a href="#">Product Development - Methods of Product Development</a>			Albers, Düser
ST 2024	76-T-MACH-105382-en	<a href="#">Methods and Processes of PGE - Product Generation Engineering</a>			Albers, Düser
WT 24/25	76-T-MACH-105382	<a href="#">Methods and Processes of PGE - Product Generation Engineering</a>			Albers, Burkardt
WT 24/25	76-T-MACH-105382-en	<a href="#">Methods and Processes of PGE - Product Generation Engineering</a>			Albers

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.

**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 2024	2233840	<a href="#">Microbiology for Engineers</a>	2 SWS	Lecture / ✕	Schwartz
Exams					
ST 2024	7232633	<a href="#">Microbiology for Engineers</a>	Schwartz		
WT 24/25	7232633	<a href="#">Microbiology for Engineers</a>	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	<a href="#">Microfluidics - Basics and Applications</a>	2 SWS	Lecture / 	Leneweit
Exams					
ST 2024	7291410	<a href="#">Microfluidics</a>			Leneweit
WT 24/25	7291410	<a href="#">Microfluidics</a>			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	<a href="#">Microfluidics - Basics and Applications with Lab Training</a>	1 SWS	Practical course / 	Leneweit
Exams					
ST 2024	7291965	<a href="#">Microfluidics - Case Studies</a>			Leneweit
WT 24/25	7291411	<a href="#">Microfluidics - Case Studies</a>			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 2024	2242110	<a href="#">Microrheology and High Frequency Rheology</a>	1 SWS	Lecture / 	Oelschlaeger
Exams					
ST 2024	7290301	<a href="#">Microrheology and High Frequency Rheology</a>			Oelschlaeger
WT 24/25	7290301	<a href="#">Microrheology and High Frequency Rheology</a>			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 2024	2245310	<a href="#">Mixing, Stirring and Agglomeration</a>	3 SWS	Lecture / 	Rhein
Exams					
ST 2024	7291907	<a href="#">Mixing, Stirring, Agglomeration</a>			Nirschl, Rhein
WT 24/25	7291907	<a href="#">Mixing, Stirring, Agglomeration</a>			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 2024	6223816	<a href="#">Modelling Wastewater Treatment Processes</a>	4 SWS	Lecture / Practice ( / ●)	Azari Najaf Abad
Exams					
ST 2024	8244112371	<a href="#">Modeling Wastewater Treatment Processes</a>			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.



**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	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	1



Events					
ST 2024	2304217	<a href="#">Modellbildung elektrochemischer Systeme</a>	2 SWS	Lecture / 	Weber
Exams					
ST 2024	7304217	<a href="#">Modelling and Simulation of Electrochemical Systems</a>			Weber
WT 24/25	7304217	<a href="#">Modelling and Simulation of Electrochemical Systems</a>			Weber





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

none

## T

**7.121 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 2024	2244110	<a href="#">Nanoparticles – Structure and Function</a>	2 SWS	Lecture / 	Meyer
ST 2024	2244111	<a href="#">Nanoparticles – Structure and Function - Exercises</a>	1 SWS	Practice / 	Meyer
Exams					
ST 2024	7292936	<a href="#">Nanoparticles – Structure and Function</a>			Meyer
ST 2024	7292936 - W	<a href="#">Nanoparticles – Structure and Function</a>			Meyer
WT 24/25	7292936	<a href="#">Nanoparticles – Structure and Function</a>			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

## 7.122 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	<a href="#">NMR for Engineers</a>	2 SWS	Lecture / 	Guthausen
WT 24/25	2245131	<a href="#">Laboratory Work for 2245130 NMR for Engineers</a>	2 SWS	Practical course / 	Guthausen
Exams					
ST 2024	7291954	<a href="#">NMR for Engineers</a>			Guthausen
WT 24/25	7291130	<a href="#">NMR for Engineers</a>			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****7.123 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	<a href="#">NMR for Engineers</a>	2 SWS	Lecture / 	Guthausen
Exams					
WT 24/25	7291130	<a href="#">NMR for Engineers</a>	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

## 7.124 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	<a href="#">Nonlinear Process Control</a>	3 SWS	Lecture / Practice ( / ●)	Meurer
Exams					
ST 2024	7243050	<a href="#">Nonlinear Process Control</a>			Meurer
WT 24/25	7200006	<a href="#">Nonlinear Process Control</a>			Meurer

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

**Prerequisites**

None.

## T

## 7.125 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 2024	0103100	<a href="#">Numerische Methoden in der Strömungsmechanik</a>	2 SWS	Lecture / 	Thäter
ST 2024	0103110	<a href="#">Übungen zu 0103100</a>	1 SWS	Practice / 	Thäter
ST 2024	0161600	<a href="#">Numerical Methods in Fluidmechanics</a>	2 SWS	Lecture	Dörfler
ST 2024	0164200	<a href="#">Numerische Methoden in der Strömungsmechanik</a>	2 SWS	Lecture	Thäter
ST 2024	0164210	<a href="#">Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik)</a>	1 SWS	Practice	Thäter
Exams					
ST 2024	7700037	<a href="#">Numerical Methods in Fluid Mechanics</a>	Dörfler		
ST 2024	7700154	<a href="#">Numerical Methods in Fluid Mechanics</a>	Dörfler		

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

## T

**7.126 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 2024	2232120	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a>	2 SWS	Lecture / 	Stein
ST 2024	2232121	<a href="#">Numerical Simulation of Reacting Multiphase Flows - Exercises</a>	2 SWS	Practice / 	Stein, und Mitarbeitende
Exams					
ST 2024	7232121	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a>			Stein
WT 24/25	7232121	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a>			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

## 7.127 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 2024	2232120	<a href="#">Numerical Simulation of Reacting Multiphase Flows</a>	2 SWS	Lecture / 🗣️	Stein
ST 2024	2232121	<a href="#">Numerical Simulation of Reacting Multiphase Flows - Exercises</a>	2 SWS	Practice / 🗣️	Stein, und Mitarbeitende
Exams					
ST 2024	7232120	<a href="#">Numerical Simulation of Reacting Multiphase Flows - Prerequisite</a>	Stein		
WT 24/25	7232120	<a href="#">Numerical Simulation of Reacting Multiphase Flows - Prerequisite</a>	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

## 7.128 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 2024	2243030	<a href="#">Optimal and Model Predictive Control</a>	2 SWS	Lecture / 	Meurer
ST 2024	2243031	<a href="#">Optimal and Model Predictive Control - Exercises</a>	1 SWS	Practice / 	Meurer
Exams					
ST 2024	7243030	<a href="#">Optimal and Model Predictive Control</a>			Meurer
WT 24/25	7250001	<a href="#">Optimal and Model Predictive Control</a>			Meurer


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





## T

## 7.129 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 2024	2106008	<a href="#">Organ support systems</a>	2 SWS	Lecture / 	Pylatiuk
Exams					
ST 2024	76-T-MACH-105228	<a href="#">Organ Support Systems</a>	Pylatiuk		
WT 24/25	76-T-MACH-105228	<a href="#">Organ Support Systems</a>	Pylatiuk		

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

Written examination (Duration: 45min)

**Prerequisites**

none

## T

## 7.130 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					
ST 2024	0162000	<a href="#">Paralleles Rechnen in Theorie und Praxis</a>	2 SWS	Lecture / 	Krause, Bülow
ST 2024	0162100	<a href="#">Übungen zu 0162000</a>	2 SWS	Practice / 	Krause, Bülow
WT 24/25	0100055	<a href="#">Parallel Computing</a>	3 SWS	Lecture	Krause, Simonis

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



## 7.131 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 2024	2244030	<a href="#">Particle Technology</a>	2 SWS	Lecture /	Dittler
ST 2024	2244031	<a href="#">Particle Technology - Exercises</a>	1 SWS	Practice /	Dittler, und Mitarbeitende
Exams					
ST 2024	7292975	<a href="#">Particle Technology Exam</a>			Dittler
WT 24/25	7292975	<a href="#">Particle Technology Exam</a>			Dittler

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

### Competence Certificate

Learning control is a written examination lasting 120 minutes.

### Prerequisites

None

## T

## 7.132 Course: Physical Chemistry (Lab) [T-CHEMBIO-109179]

**Responsible:** Dr. Tomas Kubar  
Dr. Benno Meier

**Organisation:** KIT Department of Chemistry and Biosciences

**Part of:** [M-CHEMBIO-104486 - Physical Chemistry \(incl. Lab\)](#)

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (practical)	2	pass/fail	Each winter term	1

Events					
WT 24/25	5209	<a href="#">Physical Chemistry for Chemical Engineers</a>	2 SWS	Lecture	Meier, Kubar
WT 24/25	5210	<a href="#">Übungen zur Vorlesung Physikalische Chemie für Chemieingenieure</a>	1 SWS	Practice	Meier, Kubar, Assistenten
WT 24/25	5239	<a href="#">Physikalisch-chemisches Praktikum für Chemieingenieure (Master)</a>	2 SWS	Practical course	Bickel, Die Dozenten des Instituts, Unterreiner
Exams					
WT 24/25	718200004P	<a href="#">Physical Chemistry (lab)</a>			Bickel

### Competence Certificate

The examination consists of two Parts:

1. written examination with a duration of 90 minutes (section 4 subsection 2 number 1 SPO)
2. practical course, ungraded study achievement (§ 4 Abs. 3 SPO)

### Prerequisites

None

## T

## 7.133 Course: Physical Chemistry (Written Exam) [T-CHEMBIO-109178]

**Responsible:** Dr. Tomas Kubar  
Dr. Benno Meier

**Organisation:** KIT Department of Chemistry and Biosciences

**Part of:** [M-CHEMBIO-104486 - Physical Chemistry \(incl. Lab\)](#)

**Type**  
Written examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
2

Events					
WT 24/25	5209	<a href="#">Physical Chemistry for Chemical Engineers</a>	2 SWS	Lecture	Meier, Kubar
WT 24/25	5210	<a href="#">Übungen zur Vorlesung Physikalische Chemie für Chemieingenieure</a>	1 SWS	Practice	Meier, Kubar, Assistenten
WT 24/25	5239	<a href="#">Physikalisch-chemisches Praktikum für Chemieingenieure (Master)</a>	2 SWS	Practical course	Bickel, Die Dozenten des Instituts, Unterreiner
Exams					
ST 2024	718200104	<a href="#">Physical Chemistry (written exam)</a>			Meier, Kubar
WT 24/25	718200004	<a href="#">Physical Chemistry (written exam)</a>			Kubar, Meier

### Competence Certificate

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

### Prerequisites

Lab work has to be passed.

## T

## 7.134 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 2024	2250130	<a href="#">Physical Foundations of Cryogenics</a>	2 SWS	Lecture / 	Grohmann
ST 2024	2250131	<a href="#">Physical Foundations of Cryogenics - Exercises</a>	1 SWS	Practice / 	Grohmann
Exams					
ST 2024	7200203	<a href="#">Physical Foundations of Cryogenics</a>			Grohmann
WT 24/25	7250130	<a href="#">Physical Foundations of Cryogenics</a>			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

**7.135 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**  
1

Events					
WT 24/25	2250060	<a href="#">Polymer Thermodynamics</a>	2 SWS	Lecture / 	Enders
Exams					
WT 24/25	7250060	<a href="#">Polymer Thermodynamics</a>	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



**7.136 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					
ST 2024	2220110	<a href="#">Power-to-X: Key Technology for the Energy Transition</a>	2 SWS	Lecture / 	Holtappels, Navarrete Munoz
WT 24/25	2220110	<a href="#">Power-to-X – Key Technology for the Energy Transition</a>	2 SWS	Lecture / 	Holtappels, Navarrete Munoz
Exams					
ST 2024	7220110	<a href="#">Power-to-X – Key Technology for the Energy Transition</a>			Holtappels
WT 24/25	7220110	<a href="#">Power-to-X – Key Technology for the Energy Transition</a>			Holtappels

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

**Competence Certificate**

Oral examination lastin approx. 30 minutes.

**Prerequisites**

None.

## T

**7.137 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 2024	2232060	<a href="#">Practical Course Combustion Technology</a>	3 SWS	Practical course / 	Trimis, Harth
ST 2024	2232321	<a href="#">Laboratory Work in Combustion Technology</a>	3 SWS	Practical course / 	Harth
Exams					
ST 2024	7231401	<a href="#">Practical Course Combustion Technology</a>	Harth		
WT 24/25	7231401	<a href="#">Practical Course Combustion Technology</a>	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


## 7.138 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	<a href="#">Practical Course: Water Quality and Water Assessment</a>	2 SWS	Practical course / 	Horn, Hille-Reichel, und Mitarbeitende
Exams					
ST 2024	7232664	<a href="#">Practical Course in Water Technology</a>			Horn, Abbt-Braun, Hille-Reichel
WT 24/25	7232664	<a href="#">Practical Course in Water Technology</a>			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




## 7.139 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 2024	2220330	<a href="#">Messmethoden in der Chemischen Verfahrenstechnik</a>	2 SWS	Lecture / 	Müller
ST 2024	2220331	<a href="#">Praktikum zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik</a>	1 SWS	Practical course / 	Müller
ST 2024	2220332	<a href="#">Kolloquium zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik</a>		Colloquium (K / 	Müller
Exams					
ST 2024	7210108	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>			Müller
WT 24/25	7210108	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>			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



## 7.140 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					
ST 2024	2220211	<a href="#">Praktikum zu 2220210 Katalytische Mikroreaktoren</a>	1 SWS	Practical course / 	Pfeifer, und Mitarbeitende
WT 24/25	2220211	<a href="#">Practical Course for 2220210 Catalytic Micro Reactors</a>	1 SWS	Practical course / 	Pfeifer, Dittmeyer, und Mitarbeitende
Exams					
ST 2024	7210212	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>	Pfeifer		
WT 24/25	7210212	<a href="#">Practical Course Measurement Techniques in Chemical Processing</a>	Pfeifer		

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

### Prerequisites

None





## T

**7.141 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	<a href="#">Practical Course Process Technology and Plant Design</a>	1 SWS	Practical course / 	Scheiff, und Mitarbeitende
Exams					
WT 24/25	7230101	<a href="#">practical course Process Technology and Plant Design</a>			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

## 7.142 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	<a href="#">Practical Course for 2220320 Sol-Gel Processes</a>	1 SWS	Practical course / 	Müller
Exams					
ST 2024	7210111	<a href="#">Practical Course Sol-Gel Processes</a>			Müller
WT 24/25	7210111	<a href="#">Practical Course Sol-Gel Processes</a>			Müller

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

Ungraded laboratory work (section 4, subsection 3 SPO).


**Prerequisites**





None

**T****7.143 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 2024	2241021	<a href="#">Practical in Additive Manufacturing for Process Engineering</a>	1 SWS	Practical course / 	Klahn
Exams					
ST 2024	7293102	<a href="#">Practical in Additive Manufacturing for Process Engineering</a>			Klahn

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



## T

## 7.144 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

Exams			
ST 2024	7220111	<a href="#">Practical in Power-to-X: Key Technology for the Energy Transition</a>	Holtappels
WT 24/25	7220111	<a href="#">Practical in Power-to-X: Key Technology for the Energy Transition</a>	Holtappels

### 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

**7.145 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	<a href="#">Basic principles of powder metallurgical and ceramic processing</a>	2 SWS	Lecture / 	Schell
Exams					
ST 2024	76-T-MACH-102111	<a href="#">Principles of Ceramic and Powder Metallurgy Processing</a>			Schell
WT 24/25	76-T-MACH-102111	<a href="#">Principles of Ceramic and Powder Metallurgy Processing</a>			Schell, Wagner

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

## T

**7.146 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**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Version**  
1


Events					
WT 24/25	2243060	<a href="#">Principles of Constrained Static Optimization</a>	2 SWS	Lecture / Practice ( / 🎧)	Meurer, Jerono
Exams					
ST 2024	7243060	<a href="#">Principles of Constrained Static Optimization</a>			Jerono
WT 24/25	7200054	<a href="#">Principles of Constrained Static Optimization</a>			Jerono





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

## T

**7.147 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	<a href="#">Principles of Medicine for Engineers</a>	2 SWS	Lecture / 	Pylatiuk
Exams					
ST 2024	76-T-MACH-105235	<a href="#">Principles of Medicine for Engineers</a>			Pylatiuk
WT 24/25	76-T-MACH-105235	<a href="#">Principles of Medicine for Engineers</a>			Pylatiuk

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

Written examination (Duration: 45min)

**Prerequisites**

none


**T****7.148 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 2024	2302145	<a href="#">Process Analysis: Modeling, Data Mining, Machine Learning</a>	2 SWS	Lecture / 	Borchert
Exams					
ST 2024	7302145	<a href="#">Process Analysis: Modeling, Data Mining, Machine Learning</a>			Borchert

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

## T

**7.149 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 2024	2231810	<a href="#">Process and Plant Safety</a>	2 SWS	Lecture / 	Schmidt
Exams					
ST 2024	7230200	<a href="#">Process and Plant Safety</a>	Schmidt		
WT 24/25	7230200	<a href="#">Process and Plant Safety</a>	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

**7.150 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 2024	2260810	<a href="#">Process Development in the Chemical Industry</a>	2 SWS	Block / 	Dahlhaus
Exams					
ST 2024	7280041	<a href="#">Process Development in the Chemical Industry</a>	Dahlhaus		

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

**Prerequisites**

None

## T



## 7.151 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 2024	2211010	<a href="#">Process Engineering for the Production of Food from Animal Origins</a>	2 SWS	Lecture / 	Gaukel
ST 2024	2211011	<a href="#">Process Engineering for the Production of Food from Animal Origins - Question Time</a>	1 SWS	Colloquium (K / 	Gaukel
Exams					
ST 2024	7211010	<a href="#">Process Engineering for the Production of Food from Animal Origins</a>			Gaukel
WT 24/25	7211010	<a href="#">Process Engineering for the Production of Food from Animal Origins</a>			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

**7.152 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	<a href="#">Process Engineering for the Production of Food From Plant-Based Raw Materials</a>	2 SWS	Lecture / 	van der Schaaf
Exams					
WT 24/25	7211011	<a href="#">Process Engineering for the Production of Food from Plant-Based Raw Materials</a>			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

**T****7.153 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**

none

## T

## 7.154 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**  
Oral examination





**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

Events					
WT 24/25	2245820	<a href="#">Process Instruments and Machinery and Their Process Integration</a>	2 SWS	Block / 	Nagel
Exams					
WT 24/25	7291820	<a href="#">Process Instruments and Machinery and their Process Integration</a>			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

**7.155 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 2024	2214110	<a href="#">Process Modeling in Downstream Processing</a>	2 SWS	Lecture / 	Franzreb
Exams					
ST 2024	7223015	<a href="#">Process Modeling in Downstream Processing</a>			Franzreb
WT 24/25	7223015	<a href="#">Process Modeling in Downstream Processing</a>			Franzreb

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




**Prerequisites**





None

**T****7.156 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					
ST 2024	2231011	<a href="#">Process Technology and Plant Design II</a>	3 SWS	Lecture / 	Kolb, Bajohr
WT 24/25	2231010	<a href="#">Process Technology and Plant Design I</a>	2 SWS	Lecture / 	Scheiff, Bajohr
WT 24/25	2231012	<a href="#">Practical Course Process Technology and Plant Design</a>	1 SWS	Practical course / 	Scheiff, und Mitarbeitende
Exams					
ST 2024	7230102	<a href="#">Process Technology and Plant Design Written Exam</a>			Kolb
WT 24/25	7230102	<a href="#">Process Technology and Plant Design Written Exam</a>			Scheiff

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

**Competence Certificate**

Learning control is a written examination lasting 180 minutes.

**Prerequisites**

None

**T****7.157 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 term

**Version**  
1

Events					
ST 2024	2231210	<a href="#">Processes and Process Chains for Renewable Resources</a>	2 SWS	Lecture / Practice ( / 🎧)	Dahmen, Sauer
Exams					
ST 2024	7233101	<a href="#">Processes and Process Chains for Renewable Resources</a>			Dahmen, Sauer
WT 24/25	7233101	<a href="#">Processes and Process Chains for Renewable Resources</a>			Dahmen, Sauer

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****7.158 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	<a href="#">Processing of Nanostructured Particles</a>	2 SWS	Lecture / 	Nirschl
Exams					
ST 2024	7291921	<a href="#">Processing of Nanostructured Particles</a>			Nirschl
WT 24/25	7291030	<a href="#">Processing of Nanostructured Particles</a>			Nirschl

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

None

**T****7.159 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	<a href="#">Production and Development of Cancer Therapeutics</a>	2 SWS	Lecture / 	Leneweit
Exams					
ST 2024	7291420	<a href="#">Production and Development of Cancer Therapeutics</a>			Leneweit
WT 24/25	7291420	<a href="#">Production and Development of Cancer Therapeutics</a>			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

## 7.160 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	<a href="#">Reaction Kinetics</a>	2 SWS	Lecture / 	Müller
WT 24/25	2220311	<a href="#">Exercises on 2220310 Reaction Kinetics</a>	1 SWS	Practice / 	Müller
Exams					
ST 2024	7210109	<a href="#">Reaction Kinetics</a>			Müller
WT 24/25	7210109	<a href="#">Reaction Kinetics</a>			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

## 7.161 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 2024	2220060	<a href="#">Reactor Modeling with CFD</a>	1 SWS	Lecture / 	Wehinger, Reinold
ST 2024	2220061	<a href="#">Exercise Reactor Modeling with CFD</a>	2 SWS	Practice / 	Wehinger, und Mitarbeitende
Exams					
ST 2024	7220060	<a href="#">Reactor Modeling with CFD</a>			Wehinger
WT 24/25	7220060	<a href="#">Reactor Modeling with CFD</a>			Wehinger

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

**Prerequisites**

None.

## T

## 7.162 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 2024	2231120	<a href="#">Refinery Technology - Liquid Fuels</a>	2 SWS	Lecture / 	Rauch
ST 2024	2231121	<a href="#">Refinery Technology - Exercises</a>	1 SWS	Practice / 	Rauch, und Mitarbeitende
Exams					
ST 2024	7230011	<a href="#">Refinery Technology - Liquid Fuels</a>			Rauch
WT 24/25	7230011	<a href="#">Refinery Technology - Liquid Fuels</a>			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****7.163 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	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	1

Events					
ST 2024	2250120	<a href="#">Refrigeration B</a>	2 SWS	Lecture / 	Grohmann
ST 2024	2250121	<a href="#">Refrigeration B - Exercises</a>	1 SWS	Practice / 	Grohmann, und Mitarbeitende
Exams					
ST 2024	7200202	<a href="#">Refrigeration B - Foundations of Industrial Gas Processing</a>			Grohmann
WT 24/25	7250120	<a href="#">Refrigeration B - Foundations of Industrial Gas Processing</a>			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****7.164 Course: Registration for Certificate Issuance - Supplementary Studies on  
Science, Technology and Society [T-FORUM-113587]****Responsible:** Dr. Christine Mielke  
Christine Myglas**Organisation:****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.

## T




**7.165 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					
ST 2024	2242040	<a href="#">Rheology of Disperse Systems</a>	1 SWS	Lecture / 	Willenbacher
ST 2024	2242110	<a href="#">Microrheology and High Frequency Rheology</a>	1 SWS	Lecture / 	Oelschlaeger
WT 24/25	2242030	<a href="#">Stability of Disperse Systems</a>	2 SWS	Lecture / 	Oelschlaeger, Willenbacher
Exams					
ST 2024	7290103	<a href="#">Rheology and Processing of Disperse Systems</a>			Oelschlaeger, Willenbacher, Hochstein
WT 24/25	7290103	<a href="#">Rheology and Processing of Disperse Systems</a>			Willenbacher, Oelschlaeger

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: 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 2024	2242050	<a href="#">Rheology of Polymers</a>	2 SWS	Lecture / 	Willenbacher
ST 2024	2242240	<a href="#">Rheology and Rheometry</a>	2 SWS	Lecture / 	Hochstein
Exams					
ST 2024	7290104	<a href="#">Rheology and Processing of Polymers</a>			Willenbacher, Hochstein
WT 24/25	7290104	<a href="#">Rheology and Processing of Polymers</a>			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

## 7.167 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 2024	2242240	<a href="#">Rheology and Rheometry</a>	2 SWS	Lecture / 	Hochstein
Exams					
ST 2024	7290203	<a href="#">Rheology and Rheometry</a>	Hochstein		
WT 24/25	7290203	<a href="#">Rheology and Rheometry</a>	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****7.168 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 2024	2242040	<a href="#">Rheology of Disperse Systems</a>	1 SWS	Lecture / 	Willenbacher
ST 2024	2242110	<a href="#">Microrheology and High Frequency Rheology</a>	1 SWS	Lecture / 	Oelschlaeger
Exams					
ST 2024	7290102	<a href="#">Rheology of Complex Fluids and Advanced Rheometry</a>			Oelschlaeger, Willenbacher
WT 24/25	7290102	<a href="#">Rheology of Complex Fluids and Advanced Rheometry</a>			Willenbacher, Oelschlaeger

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 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 2024	2242040	<a href="#">Rheology of Disperse Systems</a>	1 SWS	Lecture / 	Willenbacher
Exams					
ST 2024	7290101	<a href="#">Rheology of Disperse Systems</a>			Willenbacher
WT 24/25	7290101	<a href="#">Rheology of Disperse Systems</a>			Willenbacher

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

**Prerequisites**

None

## T

## 7.170 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 2024	2242050	<a href="#">Rheology of Polymers</a>	2 SWS	Lecture / 	Willenbacher
Exams					
ST 2024	7290105	<a href="#">Rheology of Polymers</a>	Willenbacher		
WT 24/25	7290105	<a href="#">Rheology of Polymers</a>	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****7.171 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	<a href="#">Seminar Biotechnological Production</a>	Holtmann

**Competence Certificate**

Examination of another type: Seminar talk lasting approx. 10 minutes.

**Prerequisites**

None

T

7.172 Course: Seminar Mathematics [T-MATH-106541]


Organisation: KIT Department of Mathematics





Part of: [M-MATH-103276 - Seminar](#)

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each term	1

Exams			
ST 2024	7700026	<a href="#">Seminar Mathematics (Vert.)</a>	Kühnlein
WT 24/25	7700039	<a href="#">Seminar Mathematics</a>	Kühnlein

**T****7.173 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**  
Oral examination**Credits**  
2**Grading scale**  
Grade to a third**Recurrence**  
Each winter term**Version**  
3

Events					
WT 24/25	2211930	<a href="#">Seminar Food Processing in Practice, incl. Excursion</a>	3 SWS	Block / 	Leister, Ellwanger, Martin
Exams					
ST 2024	7220017	<a href="#">Seminar of Food Processing in Practice with Excursion</a>	van der Schaaf		
WT 24/25	7220017	<a href="#">Seminar of Food Processing in Practice with Excursion</a>	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

**7.174 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					
ST 2024	2545082	<a href="#">SIL Entrepreneurship Project</a>		Seminar / 	Mitarbeiter
WT 24/25	2545082	<a href="#">SIL Entrepreneurship Project</a>	4 SWS	Seminar	Terzidis
Exams					
WT 24/25	7900037	<a href="#">SIL Entrepreneurship Project</a>			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

## T

## 7.175 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	<a href="#">Single-Cell Technologies</a>	2 SWS	Lecture / 	Grünberger
Exams					
ST 2024	7213030	<a href="#">Single-Cell Technologies</a>	Grünberger		
WT 24/25	7213031	<a href="#">Single-Cell Technologies</a>	Grünberger		

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

**Competence Certificate**

The learning control is an oral examination.

**Prerequisites**

None



## T

## 7.176 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	<a href="#">Sol-Gel Processes</a>	2 SWS	Lecture / 	Müller
Exams					
ST 2024	7210110	<a href="#">Sol-Gel Processes</a>			Müller
WT 24/25	7210110	<a href="#">Sol-Gel Processes</a>			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

## 7.177 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	<a href="#">Mechanical Separation Technology</a>	3 SWS	Lecture / 	Gleiß
WT 24/25	2245231	<a href="#">Exercises for 2245230 Mechanical Separation Technology</a>	1 SWS	Practice / 	Gleiß
Exams					
ST 2024	7291987	<a href="#">Solid Liquid Separation</a>			Gleiß
WT 24/25	7291230	<a href="#">Solid Liquid Separation</a>			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

**7.178 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	<a href="#">Stability of Disperse Systems</a>	2 SWS	Lecture / 	Oelschlaeger, Willenbacher
Exams					
ST 2024	7290106	<a href="#">Stability of Disperse Systems</a>			Willenbacher
WT 24/25	7290106	<a href="#">Stability of Disperse Systems</a>			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

## 7.179 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 2024	2250040	<a href="#">Statistical Thermodynamics</a>	2 SWS	Lecture / 	Enders
ST 2024	2250041	<a href="#">Statistical Thermodynamics - Exercises</a>	1 SWS	Practice / 	Enders
Exams					
ST 2024	7200103	<a href="#">Statistical Thermodynamics</a>			Enders
WT 24/25	7200103	<a href="#">Statistical Thermodynamics</a>			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****7.180 Course: Surface Effects in Process Engineering [T-CIWVT-109088]**

**Responsible:** Ioannis Nicolaou  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** [M-CIWVT-104452 - Surface Effects in Process Engineering](#)

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

**Prerequisites**  
None

## T

## 7.181 Course: Thermal Transport Processes [T-CIWVT-106034]

**Responsible:** Prof. Dr.-Ing. Thomas Wetzel  
Prof. Dr.-Ing. Tim Zeiner

**Organisation:** KIT Department of Chemical and Process Engineering

**Part of:** [M-CIWVT-104377 - Thermal Transport Processes](#)



**Type**  
Written examination





**Credits**  
6

**Grading scale**  
Grade to a third

**Recurrence**  
Each term

**Version**  
1

Events					
ST 2024	2260150	<a href="#">Thermal Transport Processes</a>	2 SWS	Lecture / 	Schabel, Wetzel
ST 2024	2260151	<a href="#">Thermal Transport Processes - Exercises</a>	2 SWS	Practice / 	Schabel, Wetzel, und Mitarbeitende
Exams					
ST 2024	7280011	<a href="#">Thermal Transport Processes</a>			Wetzel
WT 24/25	7280011	<a href="#">Thermal Transport Processes</a>			Wetzel

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

### Competence Certificate

Learning control is a written examination lasting 180 minutes.

### Prerequisites

None

## T

## 7.182 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	<a href="#">Thermodynamics III</a>	2 SWS	Lecture / 	Enders
WT 24/25	2250031	<a href="#">Thermodynamics III - Exercises</a>	1 SWS	Practice / 	Enders, und Mitarbeitende
Exams					
ST 2024	7200104	<a href="#">Thermodynamics III</a>			Enders
WT 24/25	7200104	<a href="#">Thermodynamics III</a>			Enders

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

### Competence Certificate

Learning control is a written examination lasting 90 minutes.

### Prerequisites

None

## T

**7.183 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**  
1

Events					
ST 2024	2250050	<a href="#">Thermodynamics of Interfaces</a>	2 SWS	Lecture / 	Enders
Exams					
ST 2024	7200102	<a href="#">Thermodynamics of Interfaces</a>	Enders		
WT 24/25	7200102	<a href="#">Thermodynamics of Interfaces</a>	Enders		

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



**Competence Certificate**





Erfolgskontrolle ist eine mündliche Prüfung im Umfang von 30 Minuten.



## T

**7.184 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	<a href="#">Vacuum Technology</a>	2 SWS	Lecture / 	Giegerich, Tantos
WT 24/25	2250811	<a href="#">Vacuum Technology - Exercises</a>	1 SWS	Practice / 	Giegerich, Tantos
Exams					
ST 2024	7200401	<a href="#">Vacuum Technology</a>	Day		
WT 24/25	7250810	<a href="#">Vacuum Technology</a>	Day, Giegerich		

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

## 7.185 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**  
Written examination

**Credits**  
6

**Grading scale**  
Grade to a third

**Recurrence**  
Each term

**Version**  
4

Events					
WT 24/25	6223801	<a href="#">Wastewater Treatment Technologies</a>	4 SWS	Lecture / Practice ( / 🎧)	Fuchs, Azari Najaf Abad
Exams					
ST 2024	8244109948	<a href="#">Wastewater Treatment Technologies</a>			Fuchs, Azari Najaf Abad
WT 24/25	8244109948	<a href="#">Wastewater Treatment Technologies</a>			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.

**T****7.186 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 2024	2233130	<a href="#">Circular Economy Water Energy Environment: Research Proposal Preparation</a>	4 SWS	Lecture / 	Schäfer
Exams					
ST 2024	7233130	<a href="#">Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation</a>			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 &amp; poster presentation (all day workshop with researcher participation).

**Prerequisites**

None

## T

## 7.187 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	<a href="#">Water Technology</a>	2 SWS	Lecture / 	Horn
WT 24/25	2233031	<a href="#">Exercises to Water Technology</a>	1 SWS	Practice / 	Horn, und Mitarbeitende
Exams					
ST 2024	7232621	<a href="#">Water Technology</a>			Horn
WT 24/25	7232621	<a href="#">Water Technology</a>			Horn

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