

Module Handbook

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

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KIT DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

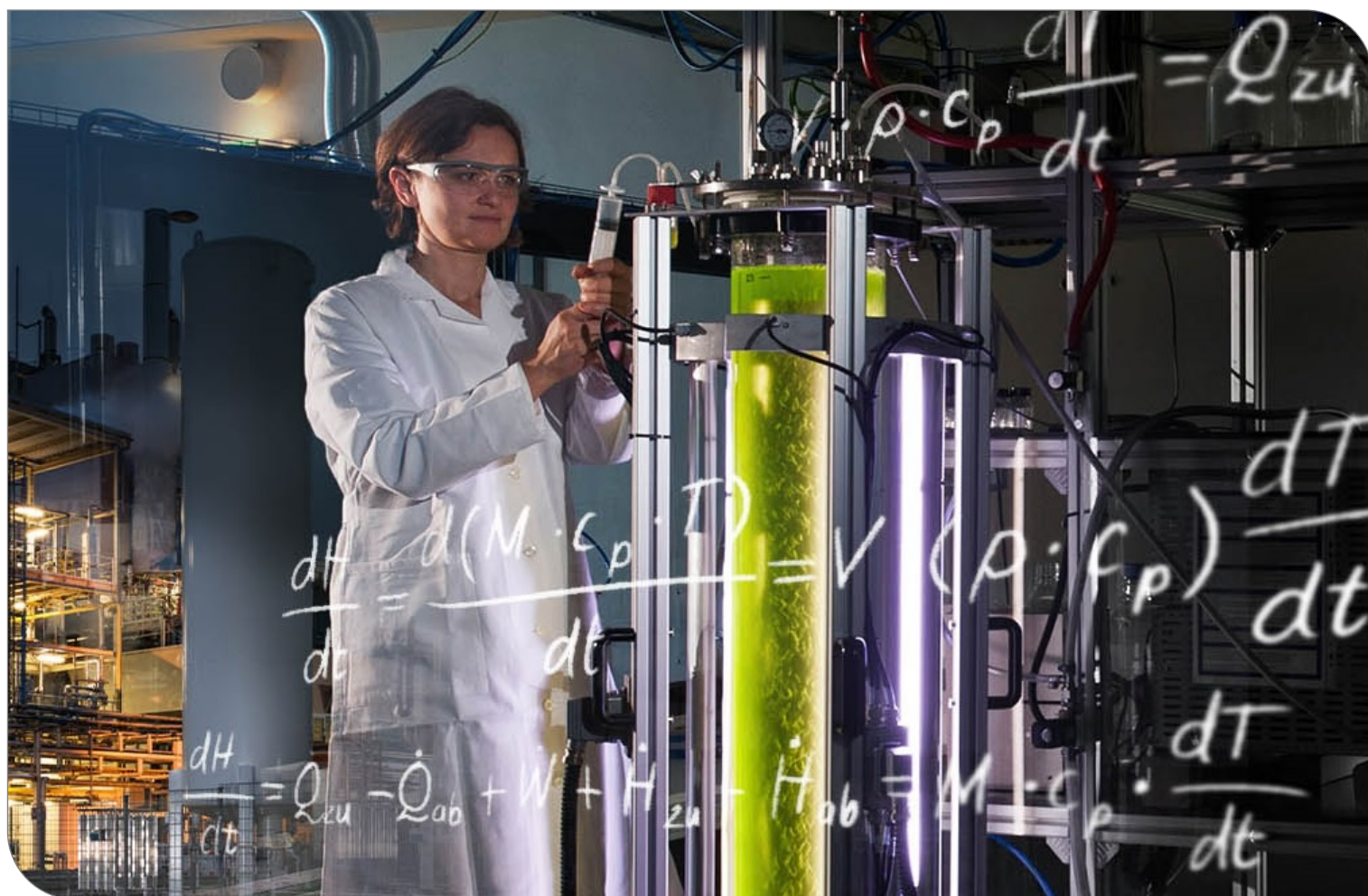


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6.152. Process Development in the Chemical Industry - T-CIWVT-108961	373
6.153. Process Engineering for the Production of Food from Animal Origins - T-CIWVT-113477	374
6.154. Process Engineering for the Production of Food from Plant-Based Raw Materials - T-CIWVT-113476	375
6.155. Process Engineering in Wastewater Treatment - T-BGU-106787	376
6.156. Process Instruments and Machinery and Their Process Integration - T-CIWVT-108910	377
6.157. Process Modeling in Downstream Processing - T-CIWVT-106101	378
6.158. Process Technology and Plant Design Written Exam - T-CIWVT-106150	379
6.159. Processes and Process Chains for Renewable Resources - T-CIWVT-108997	380
6.160. Processing of Nanostructured Particles - T-CIWVT-106107	381

6.161. Product Design II - T-CIWVT-108979	382
6.162. Production and Development of Cancer Therapeutics - T-CIWVT-113230	383
6.163. Reaction Kinetics - T-CIWVT-108821	384
6.164. Reactor Modeling with CFD - T-CIWVT-113224	385
6.165. Refinery Technology - Liquid Fuels - T-CIWVT-108831	386
6.166. Refrigeration B - Foundations of Industrial Gas Processing - T-CIWVT-108914	387
6.167. Rheology and Processing of Disperse Systems - T-CIWVT-108891	388
6.168. Rheology and Processing of Polymers - T-CIWVT-108890	389
6.169. Rheology and Rheometry - T-CIWVT-108881	390
6.170. Rheology of Complex Fluids and Advanced Rheometry - T-CIWVT-108886	391
6.171. Rheology of Disperse Systems - T-CIWVT-108963	392
6.172. Rheology of Polymers - T-CIWVT-108884	393
6.173. Selected Formulation Technologies - T-CIWVT-106037	394
6.174. Seminar Biotechnological Production - T-CIWVT-108492	395
6.175. Seminar Mathematics - T-MATH-106541	396
6.176. Seminar of Food Processing in Practice with Excursion - T-CIWVT-109129	397
6.177. SIL Entrepreneurship Project - T-WIWI-110166	398
6.178. Single-Cell Technologies - T-CIWVT-113231	399
6.179. Sol-Gel Processes - T-CIWVT-108822	400
6.180. Solid Liquid Separation - T-CIWVT-108897	401
6.181. Specialisation Module - Self Assignment BeNe - T-ZAK-112346	402
6.182. Stability of Disperse Systems - T-CIWVT-108885	403
6.183. Statistical Thermodynamics - T-CIWVT-106098	404
6.184. Structure and Reaction of Aquatic Humic Substances - T-CIWVT-108842	405
6.185. Surface Effects in Process Engineering - T-CIWVT-109088	406
6.186. Thermal Separation Processes II - T-CIWVT-108926	407
6.187. Thermal Transport Processes - T-CIWVT-106034	408
6.188. Thermodynamics III - T-CIWVT-106033	409
6.189. Thermodynamics of Interfaces - T-CIWVT-106100	410
6.190. Unit Operations and Process Chains for Food of Animal Origin - T-CIWVT-108996	411
6.191. Unit Operations and Process Chains for Food of Plant Origin - T-CIWVT-108995	412
6.192. Vacuum Technology - T-CIWVT-109154	413
6.193. Wastewater Treatment Technologies - T-BGU-109948	414
6.194. Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation - T-CIWVT-113433	415
6.195. Water Quality Assessment - T-CIWVT-108841	416
6.196. Water Technology - T-CIWVT-106802	417

1 General Information

1.1 Study program details

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

1.2 Qualification Goals

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

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

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

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

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

1.3 Studies and Examination Regulations

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

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

dated 03 May 2016, amended on 24 February 2020.

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

1.4 Organizational issues

Recognition of achievements according to § 19 SPO

A request for recognition of courses that were completed

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

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

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

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

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

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

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

Additional achievements and interdisciplinary qualification

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

Exception:

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

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>

Subject and module overview

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

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

1. Semester							2. Semester							3. Semester						4. Semester					
October	November	December	January	February		March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	
Pat Part I 5 CP				Pr			Pat Part II 3 CP				K														
WP I 6 CP					K		WP III 6 CP					K													
WP II 6 CP						K	WP IV 6 CP						K												
TE 6 CP				M			TE 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				S														
31 CP							29 CP							30 CP											
Number of graded exams: 3							Number of graded exams: 4							Number of graded exams: 6											
Number of Labs (ungraded): 1							Number of ungraded exams: 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													P: Lab												
VF: Specialized Course													P: Exam Preparation/ Oral Exam Specialized Course												

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											

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
• 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-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
• Innovative Concepts for Formulation and Processing of Printable Materials	6 LP	SS
• Instrumental Analytics	4 LP	SS
• Introduction to Numerical Simulation of Reacting Flows	8 LP	WS
• Laboratory Work in Combustion Technology	4 LP	SS
• Liquid Transportation Fuels	6 LP	WS
• Single-Cell Technologies	4 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

4 Field of study structure

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

4.1 Master's Thesis

Credits
30

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

4.2 Advanced Fundamentals

Credits
32

Election notes

Compulsory module:

- Process Technology (8 credits)

Compulsory elective modules:

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

Mandatory		
M-CIWVT-104374	Process Technology	8 CR
BIW (Election: at least 2 items)		
M-CIWVT-103065	Biopharmaceutical Purification Processes	6 CR
M-CIWVT-104384	Biotechnological Production	6 CR
M-CIWVT-103064	Selected Formulation Technologies	6 CR
M-CIWVT-105380	Membrane Technologies in Water Treatment <i>First usage possible from 4/1/2021.</i>	6 CR
M-CIWVT-106297	Bioprocess Development <i>First usage possible from 4/1/2023.</i>	6 CR
CIW (Election: at most 2 items)		
M-CIWVT-103058	Thermodynamics III	6 CR
M-CIWVT-103072	Computational Fluid Dynamics	6 CR
M-CIWVT-104377	Thermal Transport Processes	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

4.3 Technical Supplement Course

Credits

10

Examinations

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

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

Election notes

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

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

Election regulations

Elections in this field require confirmation.

Technical Supplement Course (Election: at least 10 credits)		
M-CIWVT-103051	Heat Transfer II	4 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-103064	Selected Formulation Technologies	6 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-104274	Industrial Genetics	6 CR
M-CIWVT-104283	Reaction Kinetics <i>First usage possible until 9/30/2024.</i>	6 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 10/1/2019.</i>	6 CR
M-CIWVT-104301	Water Quality Assessment <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104302	Structure and Reaction of Aquatic Humic Substances <i>First usage possible until 9/30/2024.</i>	2 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	Materials and Processes for Electrochemical Storage	4 CR
M-CIWVT-104354	Refrigeration B - Foundations of Industrial Gas Processing	6 CR
M-CIWVT-104356	Cryogenic Engineering	6 CR
M-CIWVT-104364	Industrial Crystallization <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104365	Thermal Separation Processes II <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104369	Mass Transfer II	6 CR
M-CIWVT-104370	Drying Technology	6 CR
M-CIWVT-104371	Heat Exchangers	4 CR
M-CIWVT-104374	Process Technology	8 CR
M-CIWVT-104377	Thermal Transport Processes	6 CR
M-CIWVT-104378	Particle Technology	6 CR
M-CIWVT-104383	Kinetics and Catalysis	6 CR
M-CIWVT-104384	Biotechnological Production	6 CR
M-CIWVT-104388	Development of an Innovative Food Product	6 CR
M-CIWVT-104391	Rheology of Disperse Systems	2 CR
M-CIWVT-104395	Microrheology and High Frequency Rheology	2 CR
M-CIWVT-104396	Product Design II <i>First usage possible until 9/30/2024.</i>	4 CR
M-CIWVT-104397	Innovation Management for Products & Processes in the Chemical Industry	4 CR
M-CIWVT-104401	NMR for Engineers	6 CR
M-CIWVT-104420	Unit Operations and Process Chains for Food of Plant Origin <i>First usage possible until 9/30/2024.</i>	7 CR
M-CIWVT-104421	Unit Operations and Process Chains for Food of Animal Origin <i>First usage possible until 9/30/2024.</i>	5 CR
M-CIWVT-104422	Processes and Process Chains for Renewable Resources	6 CR
M-CIWVT-104450	Measurement Techniques in Chemical Processing (including practical course)	6 CR
M-CIWVT-104451	Catalytic Micro Reactors	4 CR
M-CIWVT-104452	Surface Effects in Process Engineering	4 CR
M-CIWVT-104461	Chem-Plant	4 CR
M-MACH-100489	BioMEMS - Microsystems Technologies for Life Sciences and Medicine I	4 CR
M-MACH-100490	BioMEMS - Microsystems Technologies for Life Sciences and Medicine II	4 CR
M-MACH-100491	BioMEMS - Microsystems Technologies for Life Sciences and Medicine III	4 CR
M-MACH-102718	Product Development – Methods of Product Engineering	6 CR
M-CIWVT-104560	Instrumental Analytics	4 CR
M-BGU-103399	Process Engineering in Wastewater Treatment	6 CR
M-CHEMBIO-104486	Physical Chemistry (incl. Lab)	6 CR
M-CIWVT-104478	Vacuum Technology	6 CR
M-CIWVT-104489	Sol-Gel Processes	4 CR
M-CIWVT-104490	Measurement Techniques in Chemical Processing	4 CR
M-CIWVT-104491	Catalytic Micro Reactors (including practical course)	6 CR
M-CIWVT-104570	Biobased Plastics	4 CR
M-MATH-102932	Numerical Methods in Fluid Mechanics	4 CR
M-MACH-102702	Organ Support Systems	4 CR
M-MACH-102720	Principles of Medicine for Engineers	4 CR

M-CHEMBIO-104620	Food Chemistry Basics	4 CR
M-CIWVT-104886	Principles of Ceramic and Powder Metallurgy Processing	4 CR
M-CIWVT-103440	Practical Course in Water Technology	4 CR
M-CIWVT-104973	Digitization in Particle Technology	4 CR
M-CIWVT-105200	Liquid Transportation Fuels	6 CR
M-CIWVT-105205	Microfluidics and Case Studies	6 CR
M-CIWVT-105295	Biotechnological Use of Renewable Resources	4 CR
M-CIWVT-105380	Membrane Technologies in Water Treatment <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105407	Additive Manufacturing for Process Engineering <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105663	Membrane Reactors <i>First usage possible from 4/1/2021.</i>	4 CR
M-MATH-103276	Seminar <i>First usage possible from 4/1/2021.</i>	3 CR
M-CIWVT-105782	Digital Design in Process Engineering <i>First usage possible from 10/1/2021.</i>	6 CR
M-CIWVT-105890	NMR Methods for Product and Process Analysis <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-105891	Power-to-X – Key Technology for the Energy Transition <i>First usage possible from 4/1/2022.</i>	6 CR
M-CIWVT-105903	Industrial Wastewater Treatment <i>First usage possible from 4/1/2022.</i>	4 CR
M-ETIT-105883	Electrocatalysis <i>First usage possible from 4/1/2022.</i>	5 CR
M-CIWVT-105932	Seminar of Food Processing in Practice <i>First usage possible from 4/1/2022.</i>	2 CR
M-CIWVT-105933	Introduction to Sensory Analysis <i>First usage possible from 4/1/2022.</i>	2 CR
M-ETIT-100532	Batteries and Fuel Cells <i>First usage possible from 10/1/2022.</i>	6 CR
M-CIWVT-105993	Innovative Concepts for Formulation and Processing of Printable Materials <i>First usage possible from 10/1/2022.</i>	4 CR
M-CIWVT-105996	Extrusion Technology in Food Processing <i>First usage possible from 10/1/2022.</i>	4 CR
M-ETIT-105594	Process Analysis: Modeling, Data Mining, Machine Learning <i>First usage possible from 10/1/2022.</i>	4 CR
M-BGU-104917	Wastewater Treatment Technologies <i>First usage possible from 10/1/2022.</i>	6 CR
M-BGU-106113	Modeling Wastewater Treatment Processes <i>First usage possible from 10/1/2022.</i>	6 CR
M-CIWVT-106297	Bioprocess Development <i>First usage possible from 4/1/2023.</i>	6 CR
M-CIWVT-106314	Air Pollution Control - Laws, Technology and Application <i>First usage possible from 4/1/2023.</i>	4 CR
M-CIWVT-106313	Principles of Constrained Static Optimization <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106316	Nonlinear Process Control <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106317	Optimal and Model Predictive Control <i>First usage possible from 4/1/2023.</i>	6 CR
M-CIWVT-106318	Control of Distributed Parameter Systems <i>First usage possible from 4/1/2023.</i>	6 CR
M-CIWVT-106319	Data-Based Modeling and Control <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106320	Estimator and Observer Design <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106358	Complex Phase Equilibria <i>First usage possible from 10/1/2023.</i>	6 CR

M-CIWVT-106501	Industrial Bioprocesses <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106507	Fungal Biology and Biotechnology <i>First usage possible from 4/1/2023.</i>	4 CR
M-CIWVT-106518	Electrobiotechnology <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106526	Journal Club - Novel Bioproduction Systems <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106529	Membrane Materials & Processes Research Masterclass <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106537	Reactor Modeling with CFD <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106563	Production and Development of Cancer Therapeutics <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106564	Single-Cell Technologies <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106565	Numerical Simulation of Reacting Multiphase Flows <i>First usage possible from 4/1/2024.</i>	8 CR
M-CIWVT-106566	Chemical Hydrogen Storage <i>First usage possible from 10/1/2023.</i>	4 CR
M-MATH-106634	Computational Fluid Dynamics and Simulation Lab <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106680	Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation <i>First usage possible from 4/1/2024.</i>	5 CR
M-CIWVT-106661	Alternative Protein Technologies <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106676	Introduction to Numerical Simulation of Reacting Flows <i>First usage possible from 10/1/2024.</i>	8 CR
M-CIWVT-106595	Bioreactor Development	3 CR
M-CIWVT-106698	Process Engineering for the Production of Food from Plant-Based Raw Materials	4 CR
M-CIWVT-106699	Process Engineering for the Production of Food from Animal Origins	4 CR
M-CIWVT-103438	Fundamentals of Water Quality <i>First usage possible from 10/1/2024.</i>	6 CR
M-CIWVT-106704	Dynamics of Mechanical and Process Engineering Systems <i>First usage possible from 4/1/2024.</i>	6 CR
M-CIWVT-106715	Advanced Methods in Nonlinear Process Control <i>First usage possible from 4/1/2024.</i>	4 CR

4.4 Specialized Course I

Credits
16

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

Examinations

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

Some specialized courses are concluded with a block examination:

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

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

Election notes

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

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

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

Specialized Course I (Election: 1 item)	
Applied Rheology	16 CR
Automation and Process Systems Engineering <i>First usage possible from 4/1/2023.</i>	16 CR
Biopharmaceutical Process Engineering	16 CR
Fuel Technology	16 CR
Chemical Process Engineering	16 CR
Energy Process Engineering	16 CR
Entrepreneurship in Process Engineering <i>First usage possible from 10/1/2022.</i>	16 CR
Gas Particle Systems	16 CR
Food Process Engineering	16 CR
New Bio-Production Systems - Electro-Biotechnology <i>First usage possible from 10/1/2023.</i>	16 CR
Product Design <i>First usage possible until 9/30/2024.</i>	16 CR
Bioresource Engineering	16 CR
Mechanical Process Engineering	16 CR
Technical Thermodynamics	16 CR
Thermal Process Engineering	16 CR
Environmental Process Engineering	16 CR
Combustion Technology	16 CR
Water Technology	16 CR

4.4.1 Applied Rheology**Part of: Specialized Course I****Credits**

16

Type of examination: Oral examination of the module combination

Election notes

One of the following two modules has to be chosen:

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

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

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

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

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

has been chosen.

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

Applied Rheology (Election: at least 16 credits)		
M-CIWVT-104322	Fluid Mechanics of Non Newtonian Fluids	8 CR
M-CIWVT-104326	Rheology and Rheometry	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-104350	Microfluidics	4 CR
M-CIWVT-104370	Drying Technology	6 CR
M-CIWVT-104886	Principles of Ceramic and Powder Metallurgy Processing	4 CR
M-CIWVT-105205	Microfluidics and Case Studies	6 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105993	Innovative Concepts for Formulation and Processing of Printable Materials <i>First usage possible from 10/1/2022.</i>	4 CR

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

First usage possible from 4/1/2023.

Type of examination: Oral examination of each module

Election notes

Compulsory module:

- Nonlinear Process Control

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

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

Automation and Process Systems Engineering (Election: at least 16 credits)		
M-CIWVT-106316	Nonlinear Process Control <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106313	Principles of Constrained Static Optimization <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106317	Optimal and Model Predictive Control	6 CR
M-CIWVT-106319	Data-Based Modeling and Control <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106318	Control of Distributed Parameter Systems	6 CR
M-CIWVT-106320	Estimator and Observer Design <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-106704	Dynamics of Mechanical and Process Engineering Systems <i>First usage possible from 4/1/2024.</i>	6 CR
M-CIWVT-106715	Advanced Methods in Nonlinear Process Control <i>First usage possible from 4/1/2024.</i>	4 CR
M-ETIT-105594	Process Analysis: Modeling, Data Mining, Machine Learning	4 CR
M-CIWVT-104973	Digitization in Particle Technology	4 CR

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

Type of examination: oral/written examination of each module

Election notes

Prerequisite:

- Compulsory elective module "Biopharmaceutical Purification Processes"

One of the following modules must be chosen:

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

Biopharmaceutical Process Engineering (Election: at least 16 credits)		
M-CIWVT-103066	Process Modeling in Downstream Processing	4 CR
M-CIWVT-104266	Formulation of (Bio)pharmaceutical Therapeutics	4 CR
M-CIWVT-104273	Commercial Biotechnology	4 CR
M-MACH-100489	BioMEMS - Microsystems Technologies for Life Sciences and Medicine I	4 CR
M-MACH-100490	BioMEMS - Microsystems Technologies for Life Sciences and Medicine II	4 CR
M-MACH-100491	BioMEMS - Microsystems Technologies for Life Sciences and Medicine III	4 CR
M-MACH-102702	Organ Support Systems	4 CR
M-MACH-102720	Principles of Medicine for Engineers	4 CR
M-CIWVT-105412	Industrial Aspects in Bioprocess Technology	4 CR
M-CIWVT-105890	NMR Methods for Product and Process Analysis <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-106501	Industrial Bioprocesses <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106563	Production and Development of Cancer Therapeutics <i>First usage possible from 10/1/2023.</i>	4 CR

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

Type of examination: Oral examination of each module

Election notes

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

Fuel Technology (Election: at least 16 credits)		
M-CIWVT-103069	Combustion Technology	6 CR
M-CIWVT-103075	High Temperature Process Engineering	6 CR
M-CIWVT-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 10/1/2023.</i>	4 CR

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

Type of examination:

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

Election notes

The module "Chemical Process Engineering II" is mandatory.

The following modules can't be combined:

- Catalytic Micro Reactors
- Design of Micro Reactors

Chemical Process Engineering (Election: at least 16 credits)		
M-CIWVT-104283	Reaction Kinetics	6 CR
M-CIWVT-104284	Sol-Gel-Processes (Including Practical Course)	6 CR
M-CIWVT-104286	Design of Micro Reactors	6 CR
M-CIWVT-104450	Measurement Techniques in Chemical Processing (including practical course)	6 CR
M-CIWVT-104451	Catalytic Micro Reactors	4 CR
M-CIWVT-104489	Sol-Gel Processes	4 CR
M-CIWVT-104490	Measurement Techniques in Chemical Processing	4 CR
M-CIWVT-104491	Catalytic Micro Reactors (including practical course)	6 CR
M-CIWVT-105663	Membrane Reactors <i>First usage possible from 4/1/2021.</i>	4 CR
M-CIWVT-104281	Chemical Process Engineering II	6 CR
M-CIWVT-106537	Reactor Modeling with CFD <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106566	Chemical Hydrogen Storage <i>First usage possible from 10/1/2023.</i>	4 CR

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

Type of examination: Oral examination of each module

Election notes

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

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

- Combustion Technology
- High Temperature Process Engineering

Energy Process Engineering (Election: at least 16 credits)		
M-CIWVT-103069	Combustion Technology	6 CR
M-CIWVT-103075	High Temperature Process Engineering	6 CR
M-CIWVT-104288	Biomass Based Energy Carriers	6 CR
M-CIWVT-104289	Fuel Technology	6 CR
M-CIWVT-104292	Fluidized Bed Technology	4 CR
M-CIWVT-104293	Energy Technology	4 CR
M-CIWVT-104295	Combustion and Environment	4 CR
M-CIWVT-104296	Hydrogen and Fuel Cell Technologies	4 CR
M-CIWVT-104297	Measurement Techniques in the Thermo-Fluid Dynamics	6 CR
M-CIWVT-105206	Design of a Jet Engine Combustion Chamber <i>First usage possible from 10/1/2019.</i>	6 CR
M-CIWVT-104352	Process and Plant Safety	4 CR

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

First usage possible from 10/1/2022.

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 different projects. It should be noted that every project can only be chosen in combination with certain elective modules:

Combination 1a:

Module: Innovative Concepts for Formulation and Processing of Printable Materials

Project: Innovation Project Porous Ceramics from the 3D Printer **OR**

Project: Innovation Project Electronic Devices from Printable Conductive Materials

Combination 1b:

Module: Stability of Disperse Systems

Project: Innovation Project Porous Ceramics from the 3D Printer **OR**

Project: Innovation Project Electronic Devices from Printable Conductive Materials

Combination 2:

Module: Extrusion Technology in Food Processing

Project: Innovative Food Design by Extrusion Technology

Combination 3:

Module: Liquid Transportation Fuels

Project: Fully Renewable Fuel with Minimal Emission Levels for Marine Engines

Election regulations

Elections in this field require confirmation.

Entrepreneurship in Process Engineering (Election: at least 16 credits)		
M-CIWVT-104330	Stability of Disperse Systems	4 CR
M-CIWVT-105200	Liquid Transportation Fuels	6 CR
M-CIWVT-105993	Innovative Concepts for Formulation and Processing of Printable Materials	4 CR
M-CIWVT-105996	Extrusion Technology in Food Processing	4 CR
M-CIWVT-106017	Students Innovation Lab	12 CR

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

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

Election notes

Compulsory module:

- Gas Particle Measurement Technology

The following modules can't be combined:

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

Gas Particle Systems (Election: at least 16 credits)		
M-CIWVT-104292	Fluidized Bed Technology	4 CR
M-CIWVT-104327	Dimensional Analysis of Fluid Mechanic Problems	4 CR
M-CIWVT-104337	Gas Particle Measurement Technology	6 CR
M-CIWVT-104339	Nanoparticles – Structure and Function	6 CR
M-CIWVT-104340	Gas Particle Separation Processes	6 CR
M-CIWVT-104345	Data Analysis and Statistics	4 CR
M-CIWVT-104973	Digitization in Particle Technology	4 CR
M-CIWVT-106314	Air Pollution Control - Laws, Technology and Application <i>First usage possible from 4/1/2023.</i>	4 CR

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

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

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

Election notes

Compulsory modules:

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

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

Food Process Engineering (Election: at least 16 credits)		
M-CIWVT-103407	Water Technology	6 CR
M-CIWVT-104263	Food Science and Functionality	4 CR
M-CIWVT-104319	Microbiology for Engineers	4 CR
M-CIWVT-104370	Drying Technology	6 CR
M-CIWVT-104420	Unit Operations and Process Chains for Food of Plant Origin <i>First usage possible until 9/30/2024.</i>	7 CR
M-CIWVT-104421	Unit Operations and Process Chains for Food of Animal Origin <i>First usage possible until 9/30/2024.</i>	5 CR
M-CHEMBIO-104620	Food Chemistry Basics	4 CR
M-CIWVT-105380	Membrane Technologies in Water Treatment <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105932	Seminar of Food Processing in Practice <i>First usage possible from 4/1/2022.</i>	2 CR
M-CIWVT-105933	Introduction to Sensory Analysis <i>First usage possible from 4/1/2022.</i>	2 CR
M-CIWVT-105996	Extrusion Technology in Food Processing <i>First usage possible from 10/1/2022.</i>	4 CR
M-CIWVT-106661	Alternative Protein Technologies <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106698	Process Engineering for the Production of Food from Plant-Based Raw Materials <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106699	Process Engineering for the Production of Food from Animal Origins <i>First usage possible from 4/1/2024.</i>	4 CR

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

First usage possible from 10/1/2023.

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".

New Bio-Production Systems - Electro-Biotechnology (Election: at least 16 credits)		
M-ETIT-100532	Batteries and Fuel Cells	6 CR
M-ETIT-100377	Battery and Fuel Cells Systems <i>First usage possible from 4/1/2023.</i>	3 CR
M-CIWVT-104570	Biobased Plastics	4 CR
M-CIWVT-103441	Biofilm Systems <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106507	Fungal Biology and Biotechnology	4 CR
M-CIWVT-105295	Biotechnological Use of Renewable Resources	4 CR
M-ETIT-105883	Electrocatalysis <i>First usage possible from 4/1/2023.</i>	5 CR
M-CIWVT-106518	Electrobiotechnology	6 CR
M-CIWVT-106526	Journal Club - Novel Bioproduction Systems <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-104273	Commercial Biotechnology <i>First usage possible from 4/1/2023.</i>	4 CR
M-ETIT-100508	Modelling and Simulation of Electrochemical Systems <i>First usage possible from 4/1/2023.</i>	3 CR
M-CIWVT-106678	Industrial Biocatalysis <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106681	Industrial Genetics <i>First usage possible from 4/1/2024.</i>	4 CR
M-CHEMBIO-106697	Electrochemistry <i>First usage possible from 4/1/2024.</i>	3 CR

4.4.11 Product Design**Part of: Specialized Course I****Credits****16****Note regarding usage**

First usage possible until 9/30/2024.

Type of examination: Oral examination of the module combination

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

Election notes

- Compulsory module: The module "Product Design II" has to be chosen unless the specialization "Rheology and Product Design" has been chosen in the bachelor's program.
- The practical course in the module "Sol-Gel-Processes" can be dropped. In this case 4 credits are awarded for the module.

Product Design (Election: at least 16 credits)		
M-CIWVT-104284	Sol-Gel-Processes (Including Practical Course)	6 CR
M-CIWVT-104326	Rheology and Rheometry	4 CR
M-CIWVT-104329	Rheology of Polymers	4 CR
M-CIWVT-104330	Stability of Disperse Systems	4 CR
M-CIWVT-104339	Nanoparticles – Structure and Function	6 CR
M-CIWVT-104364	Industrial Crystallization <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104420	Unit Operations and Process Chains for Food of Plant Origin	7 CR
M-CIWVT-104421	Unit Operations and Process Chains for Food of Animal Origin	5 CR
M-CIWVT-104489	Sol-Gel Processes	4 CR
M-CIWVT-104396	Product Design II <i>First usage possible until 9/30/2024.</i>	4 CR
M-CIWVT-104886	Principles of Ceramic and Powder Metallurgy Processing	4 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-103064	Selected Formulation Technologies <i>First usage possible from 10/1/2022.</i>	6 CR

4.4.12 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

Bioresource Engineering (Election: at least 16 credits)		
M-CIWVT-104273	Commercial Biotechnology	4 CR
M-CIWVT-104288	Biomass Based Energy Carriers	6 CR
M-CIWVT-104397	Innovation Management for Products & Processes in the Chemical Industry	4 CR
M-CIWVT-104420	Unit Operations and Process Chains for Food of Plant Origin <i>First usage possible until 9/30/2024.</i>	7 CR
M-CIWVT-104421	Unit Operations and Process Chains for Food of Animal Origin <i>First usage possible until 9/30/2024.</i>	5 CR
M-CIWVT-104422	Processes and Process Chains for Renewable Resources	6 CR
M-CIWVT-104570	Biobased Plastics	4 CR
M-CIWVT-103441	Biofilm Systems	4 CR
M-CHEMBIO-104620	Food Chemistry Basics	4 CR
M-CIWVT-104266	Formulation of (Bio)pharmaceutical Therapeutics	4 CR
M-CIWVT-104342	Solid Liquid Separation	8 CR
M-CIWVT-105380	Membrane Technologies in Water Treatment <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-103064	Selected Formulation Technologies <i>First usage possible from 10/1/2022.</i>	6 CR
M-CIWVT-105295	Biotechnological Use of Renewable Resources <i>First usage possible from 10/1/2023.</i>	4 CR
M-CIWVT-106698	Process Engineering for the Production of Food from Plant-Based Raw Materials <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106699	Process Engineering for the Production of Food from Animal Origins <i>First usage possible from 4/1/2024.</i>	4 CR

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

Type of examination: Oral examination of each module

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

Election notes

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

Processes for Particle Engineering (Election: at least 16 credits)		
M-CIWVT-103073	Processing of Nanostructured Particles	6 CR
M-CIWVT-104284	Sol-Gel-Processes (Including Practical Course)	6 CR
M-CIWVT-104327	Dimensional Analysis of Fluid Mechanic Problems	4 CR
M-CIWVT-104339	Nanoparticles – Structure and Function	6 CR
M-CIWVT-104340	Gas Particle Separation Processes	6 CR
M-CIWVT-104342	Solid Liquid Separation	8 CR
M-CIWVT-104345	Data Analysis and Statistics	4 CR
M-CIWVT-104350	Microfluidics	4 CR
M-CIWVT-104351	Process Instruments and Machinery and Their Process Integration	4 CR
M-CIWVT-104353	Materials and Processes for Electrochemical Storage	4 CR
M-CIWVT-104401	NMR for Engineers	6 CR
M-MATH-102932	Numerical Methods in Fluid Mechanics	4 CR
M-CIWVT-104560	Instrumental Analytics	4 CR
M-CIWVT-104489	Sol-Gel Processes	4 CR
M-CIWVT-104337	Gas Particle Measurement Technology	6 CR
M-CIWVT-104973	Digitization in Particle Technology	4 CR
M-CIWVT-105205	Microfluidics and Case Studies	6 CR
M-CIWVT-105399	Mixing, Stirring, Agglomeration <i>First usage possible from 4/1/2020.</i>	6 CR
M-MATH-103276	Seminar <i>First usage possible from 4/1/2021.</i>	3 CR
M-CIWVT-105890	NMR Methods for Product and Process Analysis <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-103064	Selected Formulation Technologies <i>First usage possible from 10/1/2022.</i>	6 CR
M-CIWVT-106314	Air Pollution Control – Laws, Technology and Application <i>First usage possible from 4/1/2023.</i>	4 CR
M-CIWVT-106501	Industrial Bioprocesses <i>First usage possible from 10/1/2023.</i>	4 CR
M-MATH-106634	Computational Fluid Dynamics and Simulation Lab <i>First usage possible from 4/1/2024.</i>	4 CR
M-CIWVT-106704	Dynamics of Mechanical and Process Engineering Systems <i>First usage possible from 4/1/2024.</i>	6 CR

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

Type of examination: Oral examination of each module

Election notes

Prerequisite:

- Compulsory elective module "Thermodynamics III"

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

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

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

Technical Thermodynamics (Election: at least 16 credits)		
M-CIWVT-103059	Statistical Thermodynamics	6 CR
M-CIWVT-103063	Thermodynamics of Interfaces	4 CR
M-CIWVT-103068	Physical Foundations of Cryogenics	6 CR
M-CIWVT-104284	Sol-Gel-Processes (Including Practical Course)	6 CR
M-CIWVT-104354	Refrigeration B - Foundations of Industrial Gas Processing	6 CR
M-CIWVT-104356	Cryogenic Engineering	6 CR
M-CIWVT-104365	Thermal Separation Processes II <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104478	Vacuum Technology	6 CR
M-CIWVT-104489	Sol-Gel Processes	4 CR
M-CIWVT-104461	Chem-Plant <i>First usage possible from 4/1/2023.</i>	4 CR
M-CIWVT-106358	Complex Phase Equilibria <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-104297	Measurement Techniques in the Thermo-Fluid Dynamics <i>First usage possible from 10/1/2023.</i>	6 CR
M-CIWVT-104283	Reaction Kinetics <i>First usage possible from 10/1/2023.</i>	6 CR

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

Type of examination: Oral examination of the module combination

Election notes

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

- Heat Transfer II
- Mass Transfer II
- Drying Technology
- Heat Exchangers

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

- Heat Transfer II
- Mass Transfer II
- Drying Technology
- Heat Exchangers
- High Temperature Process Engineering
- Measurement Techniques in the Thermo-Fluid Dynamics

Thermal Process Engineering (Election: at least 16 credits)		
M-CIWVT-103051	Heat Transfer II	4 CR
M-CIWVT-103059	Statistical Thermodynamics	6 CR
M-CIWVT-103075	High Temperature Process Engineering	6 CR
M-CIWVT-104297	Measurement Techniques in the Thermo-Fluid Dynamics	6 CR
M-CIWVT-104354	Refrigeration B - Foundations of Industrial Gas Processing	6 CR
M-CIWVT-104364	Industrial Crystallization <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104365	Thermal Separation Processes II <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104369	Mass Transfer II	6 CR
M-CIWVT-104370	Drying Technology	6 CR
M-CIWVT-104371	Heat Exchangers	4 CR
M-CIWVT-104352	Process and Plant Safety	4 CR

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

Type of examination: Oral examination of each module

Election notes

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

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

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

Environmental Process Engineering (Election: at least 16 credits)		
M-CIWVT-103407	Water Technology	6 CR
M-CIWVT-104289	Fuel Technology	6 CR
M-CIWVT-104340	Gas Particle Separation Processes	6 CR
M-CIWVT-104352	Process and Plant Safety	4 CR
M-CIWVT-105200	Liquid Transportation Fuels	6 CR
M-CIWVT-105903	Industrial Wastewater Treatment <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-106314	Air Pollution Control - Laws, Technology and Application <i>First usage possible from 4/1/2023.</i>	4 CR
M-CIWVT-104295	Combustion and Environment	4 CR

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

Type of examination: Oral examination of the module combination

Election notes

Compulsory module:

- Combustion Technology

Combustion Technology (Election: at least 16 credits)		
M-CIWVT-103069	Combustion Technology	6 CR
M-CIWVT-103075	High Temperature Process Engineering	6 CR
M-CIWVT-104288	Biomass Based Energy Carriers	6 CR
M-CIWVT-104289	Fuel Technology	6 CR
M-CIWVT-104293	Energy Technology	4 CR
M-CIWVT-104294	Flow and Combustion Instabilities in Technical Burner Systems	4 CR
M-CIWVT-104295	Combustion and Environment	4 CR
M-CIWVT-104296	Hydrogen and Fuel Cell Technologies	4 CR
M-CIWVT-104297	Measurement Techniques in the Thermo-Fluid Dynamics	6 CR
M-CIWVT-105206	Design of a Jet Engine Combustion Chamber <i>First usage possible from 10/1/2019.</i>	6 CR
M-CIWVT-104321	Practical Course Combustion Technology	4 CR

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

Type of examination: Oral examination of the module combination

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

Election notes

Compulsory module:

- Water Technology

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

- Water Quality Assessment
- Industrial Wastewater Treatment
- Membrane Technologies in Water Treatment

Further requirements:

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

Water Technology (Election: at least 16 credits)		
M-CIWVT-103407	Water Technology	6 CR
M-CIWVT-103441	Biofilm Systems	4 CR
M-CIWVT-104301	Water Quality Assessment <i>First usage possible until 9/30/2024.</i>	6 CR
M-CIWVT-104302	Structure and Reaction of Aquatic Humic Substances <i>First usage possible until 9/30/2024.</i>	2 CR
M-CIWVT-104319	Microbiology for Engineers	4 CR
M-CIWVT-104401	NMR for Engineers	6 CR
M-CIWVT-103440	Practical Course in Water Technology <i>First usage possible from 10/1/2019.</i>	4 CR
M-CIWVT-104560	Instrumental Analytics	4 CR
M-CIWVT-105380	Membrane Technologies in Water Treatment <i>First usage possible from 4/1/2020.</i>	6 CR
M-CIWVT-105890	NMR Methods for Product and Process Analysis <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-105903	Industrial Wastewater Treatment <i>First usage possible from 4/1/2022.</i>	4 CR
M-CIWVT-103438	Fundamentals of Water Quality <i>First usage possible from 10/1/2024.</i>	6 CR

4.5 Internship**Credits****14**

Mandatory		
M-CIWVT-104527	Internship	14 CR

4.6 Additional Examinations

Additional Examinations (Election: at most 30 credits)		
M-CIWVT-104389	Process Development in the Chemical Industry	2 CR
M-ZAK-106099	Supplementary Studies on Sustainable Development <i>First usage possible between 4/1/2023 and 4/1/2023.</i>	19 CR
M-ZAK-106235	Supplementary Studies on Culture and Society <i>First usage possible between 4/1/2023 and 4/1/2023.</i>	22 CR

5 Modules

M

5.1 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**5.2 Module: Advanced Methods in Nonlinear Process Control [M-CIWVT-106715]**

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

Organisation: KIT Department of Chemical and Process Engineering

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

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

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

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

M**5.3 Module: Air Pollution Control - Laws, Technology and Application [M-CIWVT-106314]**

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

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

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

Competence Certificate

Oral examination, duration approx. 20 minutes.

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

M

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

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

Content

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

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

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

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

- **Course location:** Seminar room, nexnoa GmbH, Durmersheimerstr. 188A, 76189 Karlsruhe
- **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**5.5 Module: Batteries and Fuel Cells [M-ETIT-100532]****Responsible:** Prof. Dr.-Ing. Ulrike Krewer**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2022)
[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

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

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

Prerequisites

none

M**5.6 Module: Battery and Fuel Cells Systems [M-ETIT-100377]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)**Credits**
3**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

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

M**5.7 Module: Biobased Plastics [M-CIWVT-104570]****Responsible:** Prof. Dr. Ralf Kindervater**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Bioresource Engineering](#)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#)

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

Mandatory			
T-CIWVT-109369	Biobased Plastics	4 CR	Kindervater

Competence Certificate

Verteifungsfach:

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

Technisches Ergänzungsfach or a large number of students:

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

The grade of the oral examination is the module grade.

Prerequisites

None

Workload

120 h:

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

M**5.8 Module: Biofilm Systems [M-CIWVT-103441]**

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

Organisation: KIT Department of Chemical and Process Engineering

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

Grade of the module is the grade of oral examination.

Workload

Attendance time: 30 h

Preparation/follow-up: 30 h

Examination + exam preparation: 60 h

M**5.9 Module: Biomass Based Energy Carriers [M-CIWVT-104288]**

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Production, properties, and characterization of biomass.

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

Utilization and conversion of biogenic oils and fats.

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

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

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

M**5.10 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine I [M-MACH-100489]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

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

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

Competence Certificate

Written exam (75 min)

Prerequisites

none

Competence Goal

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

Content

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

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

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

Literature

Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

M. Madou

Fundamentals of Microfabrication

Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

M**5.11 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine II [M-MACH-100490]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

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

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

Competence Certificate

Written exam (75 min)

Prerequisites

None

Competence Goal

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

Content

Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:

LabCD, Protein Crystallisation

Microarrays

Tissue Engineering

Cell Chip Systems

Drug Delivery Systems

Micro reaction technology

Microfluidic Cells for FTIR-Spectroscopy

Microsystem Technology for Anesthesia, Intensive Care and Infusion

Analysis Systems of Person's Breath

Neurobionics and Neuroprosthesis

Nano Surgery

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

Literature

Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;

Springer-Verlag, 1994

M. Madou

Fundamentals of Microfabrication

M**5.12 Module: BioMEMS - Microsystems Technologies for Life Sciences and Medicine III [M-MACH-100491]****Responsible:** Prof. Dr. Andreas Guber**Organisation:** KIT Department of Mechanical Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Biopharmaceutical Process Engineering](#)

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

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

Competence Certificate

Written exam (75 min)

Prerequisites

none

Competence Goal

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

Content

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

Workload

Literature: 20 h

Lessons: 21 h

Preparation and Review: 50 h

Exam preparation: 30 h

Literature

Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II; Springer-Verlag, 1994

M. Madou

Fundamentals of Microfabrication

M**5.13 Module: Biopharmaceutical Purification Processes [M-CIWVT-103065]**

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

Process development of biopharmaceutical processes

Content

Detailed discussion of biopharmaceutical purification processes

Workload

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

Learning type

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

Literature

Vorlesungsskript

M

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

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

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

Mandatory			
T-CIWVT-112766	Bioprocess Development	6 CR	Grünberger

Competence Certificate

Written examination; duration 120 minutes.

Prerequisites

None

Competence Goal

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

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

Content

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

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

Optional topics include:

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

Module grade calculation

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

Workload

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

M**5.15 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
3

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

Mandatory			
T-CIWVT-113315	Bioreactor Development	3 CR	Holtmann

M

5.16 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	1

Mandatory			
T-CIWVT-106030	Biotechnological Production	6 CR	Holtmann
T-CIWVT-108492	Seminar Biotechnological Production	0 CR	Holtmann

Competence Certificate

The learning control consists of two partial achievements:

- Completed coursework/ prerequisite for the oral exam: Seminar talk lasting approx. 10 minutes during the course
- 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

The module grade is the grade of the written exam.

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

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

M**5.18 Module: Catalytic Micro Reactors [M-CIWVT-104451]**

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

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

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

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.19 Module: Catalytic Micro Reactors (including practical course) [M-CIWVT-104491]**

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

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

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

Competence Certificate

The Examination consists of:

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M

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

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

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

Catalytic processes for gas cleaning and conditioning.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

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

M

5.21 Module: Chemical Hydrogen Storage [M-CIWVT-106566]

Responsible: TT-Prof. Dr. Moritz Wolf

Organisation: KIT Department of Chemical and Process Engineering

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

Announced in lectures/on slides.

Fundamentals:

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

M**5.22 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	Chemical Process Engineering II	6 CR	Wehinger

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

Skript "Chemische Verfahrenstechnik II"

M

5.23 Module: Chem-Plant [M-CIWVT-104461]**Responsible:** Prof. Dr. Sabine Enders**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 4/1/2023)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
5**Version**
1

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

Prerequisites

None

Competence Goal

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

Content

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

Workload

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

M**5.24 Module: Combustion and Environment [M-CIWVT-104295]**

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

M**5.25 Module: Combustion Technology [M-CIWVT-103069]**

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

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

Mandatory			
T-CIWVT-106104	Combustion Technology	6 CR	Trimis

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Workload

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

Literature

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

M

5.26 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

5.27 Module: Complex Phase Equilibria [M-CIWVT-106358]**Responsible:** Prof. Dr. Sabine Enders**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 10/1/2023)

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

Mandatory			
T-CIWVT-112883	Complex Phase Equilibria	6 CR	Enders

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

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

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

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

Competence Certificate

Learning control is a written examination lasting 90 minutes

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the written examination.

Workload

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

Literature

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

M**5.29 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	Computational Fluid Dynamics and Simulation Lab	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**5.30 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	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids	4 CR	Hochstein

Competence Certificate

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

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

Prerequisites

None

Module grade calculation

The module grade is the grade of oral examination.

Workload

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

M**5.31 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	Control of Distributed Parameter Systems	6 CR	Meurer

Competence Certificate

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

Prerequisites

none

Module grade calculation

Modulnote ist die Note der mündlichen Prüfung.

Workload

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

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

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

M**5.32 Module: Cryogenic Engineering [M-CIWVT-104356]**

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

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

Mandatory			
T-CIWVT-108915	Cryogenic Engineering	6 CR	Grohmann

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.33 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 winter term	1 term	German	4	1

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.34 Module: Data-Based Modeling and Control [M-CIWVT-106319]**

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

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

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

Competence Certificate

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

Prerequisites

none

Content

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

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

Module grade calculation

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

Workload

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

Self-study: 75 hrs.

Exam preparation: 60 hrs.

Literature

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

M**5.35 Module: Design of a Jet Engine Combustion Chamber [M-CIWVT-105206]****Responsible:** Dr.-Ing. Stefan Raphael Harth**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2019)[Specialized Course I / Energy Process Engineering](#) (Usage from 10/1/2019)[Specialized Course I / Combustion Technology](#) (Usage from 10/1/2019)

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

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

Competence Certificate

Learning control is an examination of another kind according to § 4 Abs. 2 Nr. 3 SPO.

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.

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

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

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Workload

Lectures: 45 h

Homework: 42 h

Exam preparation: 60 h (about 1.5 weeks)

Literature

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

M**5.37 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	Development of an Innovative Food Product	3 CR	van der Schaaf
T-CIWVT-111010	Development of an Innovative Food Product - presentation	3 CR	van der Schaaf

Competence Certificate

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

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

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

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

Competence Certificate

The learning control consists of:

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

The laboratory is a prerequisite for the oral exam.

Prerequisites

None.

Competence Goal

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

Content

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

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Recommendation

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

M**5.39 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	Digitization in Particle Technology	4 CR	Gleiß

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The Module grade is the grade of the oral examination.

Workload

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

M**5.40 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	Dimensional Analysis of Fluid Mechanic Problems	4 CR	Hochstein

Competence Certificate

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

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.41 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 winter term	1 term	German	4	1

Mandatory			
T-CIWVT-108936	Drying Technology	6 CR	Schabel

Competence Certificate

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

Prerequisites

None

Competence Goal

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

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

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

Content

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

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.42 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	Dynamics of Mechanical and Process Engineering Systems - Prerequisite	3 CR	Jerono
T-CIWVT-113486	Dynamics of Mechanical and Process Engineering Systems - Exam	3 CR	Jerono

Competence Certificate

The Learning control consists of two partial achievements:

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

Module grade calculation

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

M**5.43 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	1

Mandatory			
T-CIWVT-113140	Electrobiotechnology Seminar	2 CR	Holtmann
T-CIWVT-113148	Electrobiotechnology	4 CR	Holtmann

M

5.44 Module: Electrocatalysis [M-ETIT-105883]

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

Organisation: KIT Department of Electrical Engineering and Information Technology

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

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

Mandatory			
T-ETIT-111831	Electrocatalysis	6 CR	Röse

Competence Certificate

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

Prerequisites

none

Competence Goal

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

Content

Lecture:

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

Module grade calculation

The module grade is the grade of the written examination.

Workload

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

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

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

preparation of examination and attendance in examination: 40 h

A total of 150 h = 5 CR

Recommendation

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

M**5.45 Module: Electrochemistry [M-CHEMBIO-106697]****Organisation:** KIT Department of Chemistry and Biosciences**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2024)**Credits**

3

Grading scale

Grade to a tenth

Recurrence

Irregular

Duration

1 term

Language

German

Level

4

Version

1

Mandatory

T-CHEMBIO-109773	Electrochemistry	3 CR	
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Prerequisites

None

M**5.46 Module: Energy Technology [M-CIWVT-104293]**

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

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

Mandatory			
T-CIWVT-108833	Energy Technology	4 CR	Büchner

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.47 Module: Environmental Biotechnology [M-CIWVT-104320]**

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

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

Mandatory			
T-CIWVT-106835	Environmental Biotechnology	4 CR	Tiehm

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.48 Module: Estimator and Observer Design [M-CIWVT-106320]****Responsible:** Dr.-Ing. Pascal Jerono**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

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

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

Competence Certificate

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

Content

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

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

Module grade calculation

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

Workload

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

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

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

M**5.49 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)[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-112174	Extrusion Technology in Food Processing	4 CR	

Competence Certificate

Learning control is an oral exam lasting about 20 minutes.

Prerequisites

None.

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

Will be announced.

M**5.50 Module: Flow and Combustion Instabilities in Technical Burner Systems
[M-CIWVT-104294]**

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

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

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

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.51 Module: Fluid Mechanics of Non Newtonian Fluids [M-CIWVT-104322]**

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

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

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

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.52 Module: Fluidized Bed Technology [M-CIWVT-104292]**

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

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

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

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

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

Content

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

Workload

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

Literature

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

M**5.53 Module: Food Chemistry Basics [M-CHEMBIO-104620]**

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

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

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

Prerequisites

None

Workload

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

M**5.54 Module: Food Science and Functionality [M-CIWVT-104263]**

Responsible: Prof. Dr. Bernhard Watzl
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 winter term	1 term	German	4	1

Mandatory			
T-CIWVT-108801	Food Science and Functionality	4 CR	Watzl

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

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**5.55 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 summer term	1 term	German	5	1

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

M**5.56 Module: Fuel Technology [M-CIWVT-104289]****Responsible:** Prof. Dr.-Ing. Thomas Kolb**Organisation:** KIT Department of Chemical and Process Engineering

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

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

Mandatory			
T-CIWVT-108829	Fuel Technology	6 CR	Kolb

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

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

Mandatory			
T-CIWVT-106838	Fundamentals of Water Quality	6 CR	Abbt-Braun

Competence Certificate

Written exam, 90 min

according to SPO § 4 Abs. 2 Nr. 1.

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.

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**5.58 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	1

Mandatory			
T-CIWVT-113125	Fungal Biology Biotechnology Seminar	2 CR	Ochsenreither
T-CIWVT-113150	Fungal Biology Biotechnology	2 CR	Ochsenreither

Competence Certificate

The learning control consists of two partial achievements:

- Ungraded coursework: 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 grade of oral examination.

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

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.60 Module: Gas Particle Separation Processes [M-CIWVT-104340]****Responsible:** Dr.-Ing. Jörg Meyer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** **Technical Supplement Course**

Specialized Course I / Gas Particle Systems

Specialized Course I / Mechanical Process Engineering

Specialized Course I / Environmental Process Engineering

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.61 Module: Heat Exchangers [M-CIWVT-104371]**

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

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

Mandatory			
T-CIWVT-108937	Heat Exchangers	4 CR	Wetzel

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.62 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
4	Grade to a tenth	Each winter term	1 term	German	4	3

Mandatory			
T-CIWVT-106067	Heat Transfer II	4 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): 30 h
- Homework: 50 h
- Exam Preparation: 40 h

Literature

Von Böckh/Wetzel: „Wärmeübertragung“, Springer, 6. Auflage 2015

VDI-Wärmeatlas, Springer-VDI, 10. Auflage, 2011

M**5.63 Module: High Temperature Process Engineering [M-CIWVT-103075]**

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

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

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

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.64 Module: Hydrogen and Fuel Cell Technologies [M-CIWVT-104296]**

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade ist 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**5.65 Module: Industrial Aspects in Bioprocess Technology [M-CIWVT-105412]****Responsible:** Prof. Dr. Jürgen Hubbuch**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Specialized Course I / Biopharmaceutical Process Engineering](#)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
5**Version**
1

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

- Industrial Aspects on process development.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.66 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

Voraussetzungen sind Grundkenntnisse in Biochemie und Enzymtechnik

Basic knowledge of biochemistry and enzyme technology is required.

Literature

Recent publications in relevant journals,

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

M

5.67 Module: Industrial Bioprocesses [M-CIWVT-106501]**Responsible:** 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**5.68 Module: Industrial Crystallization [M-CIWVT-104364]**

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Thermal Process Engineering](#) (Usage until 9/30/2024)
[Specialized Course I / Product Design](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108925	Industrial Crystallization	6 CR	Kind

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

Acquisition of deep understanding of processes using the example of industrial crystallization. Transfer of this understanding into a numerical model.

Content

Crystallization processes and apparatus; Solubility, nucleation and growth kinetics; Modeling and Simulation of the particle size distribution in continuous and batch operated crystallizers; Numerical methods for solving the coupled mass and population balance; Apparatus design, determination of the principal dimensions of forced circulation crystallizers (python, excel or other programming language).

Module grade calculation

The grade of the oral examination is the module grade.

Annotation

The module expires. Lectures are not longer offered. Exams can be taken until the end of September 2024.

Workload

- Attendance time (Lecture): 40 h
- Homework: 70 h
- Exam Preparation: 70 h

Literature

- Gnielinski, V.; Mersmann, A.; Thurner, F. Verdampfung, Kristallisation, Trocknung; Vieweg, 1993
- Mersmann, A.; Kind, M.; Stichlmair, J. Thermische Verfahrenstechnik, 2nd ed.; Springer, 2005
- Mullin, J. W. Crystallization, 3rd ed.; Butterworth-Heinemann, 1993
- Randolph, A. D.; Larson, M. A. Theory of particulate processes; Academic Press, 1971

M**5.69 Module: Industrial Genetics [M-CIWVT-104274]**

Responsible: Dr. Anke Neumann
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 summer term	1 term	German	4	1

Mandatory			
T-CIWVT-108812	Industrial Genetics	6 CR	Neumann

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.

In the preparation of the seminar presentation, the students show that texts describing such methods can be analyzed and the industrial applicability of these methods can be critically discussed.

Content

Lecture: 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.

Seminar: 10 min Lecture on a current example from industrial genetic engineering. Topics will be provided.

M**5.70 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**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

Mandatory			
T-CIWVT-113434	Industrial Genetics	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

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

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

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

M**5.72 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	4	1

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

Competence Certificate

The examination is a written examination (multiple choice) with a duration of about 30 minutes (section 4 subsection 2 number 1 SPO).

The grade of the written examination is the module grade.

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.

Workload

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

M**5.73 Module: Innovative Concepts for Formulation and Processing of Printable Materials [M-CIWVT-105993]**

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

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

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

Competence Certificate

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

Prerequisites

None.

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

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

M**5.74 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](#)
[Specialized Course I / Water Technology](#)
[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/English	4	1

Mandatory			
T-CIWVT-106837	Instrumental Analytics	4 CR	Guthausen

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 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, μ 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**5.75 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	Internship	14 CR	Bajohr, Freudig

Workload

12 weeks (420 h - 480 h)

M**5.76 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	Introduction to Numerical Simulation of Reacting Flows - Prerequisite	6 CR	Stein
T-CIWVT-113436	Introduction to Numerical Simulation of Reacting Flows	2 CR	Stein

Competence Certificate

The learning control consists of two partial achievements:

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

Prerequisites

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 Matlab 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 Matlab
- 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 Matlab 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**5.77 Module: Introduction to Sensory Analysis [M-CIWVT-105933]****Responsible:** Prof. Dr. Katharina Scherf**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2022)[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2022)**Credits**

2

Grading scale

Grade to a tenth

Recurrence

Each summer term

Duration

1 term

Language

German

Level

4

Version

1

Mandatory

T-CIWVT-109128

[Introduction to Sensory Analysis with Practice](#)

2 CR

Scherf

M**5.78 Module: Journal Club - Novel Bioproduction Systems [M-CIWVT-106526]****Responsible:** Prof. Dr.-Ing. Dirk Holtmann**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)[Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2024)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German/English**Level**
5**Version**
1

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

M

5.79 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
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

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

Competence Certificate

Learning control is a written examination lasting 60 minutes.

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

The module grade is the grade of the written exam.

Workload

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

Literature

- 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**5.80 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](#)
[Specialized Course I / Entrepreneurship in Process Engineering](#)**Credits**
6**Grading scale**
Grade to a tenth**Recurrence**
Each winter term**Duration**
1 term**Language**
English**Level**
4**Version**
2

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content

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

Module grade calculation

Grade of the Module ist the grade of oral examination.

Workload

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

Literature

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

M**5.81 Module: Mass Transfer II [M-CIWVT-104369]**

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

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

Mandatory			
T-CIWVT-108935	Mass Transfer II	6 CR	Schabel

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): 45 h
- Homework: 90 h
- Exam Preparation: 45 h

M**5.82 Module: Materials and Processes for Electrochemical Storage [M-CIWVT-104353]**

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

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

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

Competence Certificate

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

Prerequisites

None

Competence Goal

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

Content**Electrochemical basics**

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

Basics of electrochemical storage systems and fuel cells.

Structure and operation of primary and secondary batteries:

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

Design and operation of fuel cells:

PEMFC, AMFC, DMFC, SOFC, MCFC.

Materials and processes for electrochemical storage systems

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

Electrolyte additives and electrode coatings,

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

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

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

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

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

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

Production processes for separation foils for different battery systems

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

Manufacturing processes for stack components for fuel cells

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.83 Module: Measurement Techniques in Chemical Processing [M-CIWVT-104490]**

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

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
5

Version
1

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

Competence Certificate

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

Prerequisites

None

Competence Goal

Students are capable to discuss various measurement methods and are able to compare and analyse different measurement principles.

Due to the mentioned aims, students are able to criticise and rate various measurement methods.

Content

Theory and practice of online measurement methods e.g.: pressure, temperature, pH value and material properties for example: density.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 22,5 h
- Homework: 26 h
- Exam Preparation: 80 h

M**5.84 Module: Measurement Techniques in Chemical Processing (including practical course) [M-CIWVT-104450]**

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

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
5

Version
1

Mandatory			
T-CIWVT-109086	Measurement Techniques in Chemical Processing	4 CR	Müller
T-CIWVT-109181	Practical Course Measurement Techniques in Chemical Processing	2 CR	Müller

Competence Certificate

The examination consists of:

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to discuss various measurement methods and are able to compare and analyse different measurement principles.

Due to the mentioned aims, students are able to criticise and rate various measurement methods.

Content

Theory and practice of online measurement methods e.g.: pressure, temperature, pH value and material properties for example: density.

Workload

- Attendance time (Lecture): 22,5 h
- Internship: 11.5 h, 8 attempts
- Homework: 26 h
- Exam Preparation: 120 h

M**5.85 Module: Measurement Techniques in the Thermo-Fluid Dynamics [M-CIWVT-104297]**

Responsible: Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Thermal Process Engineering](#)
[Specialized Course I / Technical Thermodynamics](#) (Usage from 10/1/2023)
[Specialized Course I / Combustion Technology](#)

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

Mandatory			
T-CIWVT-108837	Measurement Techniques in the Thermo-Fluid Dynamics	6 CR	Trimis

Competence Certificate

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

Prerequisites

None

Competence Goal

- The students are able to plan an experiment, select the appropriate quantities to be measured and identify the appropriate dimensionless numbers for the universal representation of the results.
- The students have a thorough understanding of several advanced measuring techniques used for basic research in thermofluids. They are able to select the most appropriate technique for an experimental study.
- The students can assess the accuracy and limitations of measuring techniques quantitatively.
- The students understand the different time scales of involved phenomena and the stochastic nature of experiments, measuring techniques and turbulent flows. They are able to accurately process acquired measurement data in the time and in the spectral domain.

Content

- Design of experiment and dimensional analysis
- Flow visualization (light sheet techniques, shadowgraphy, Schlieren and interferometry)
- Laser Doppler Anemometry
- Phase Doppler Anemometry
- Particle Image Velocimetry
- Laser Induced Fluorescence
- Absorption spectroscopy
- Overview of further techniques
- Data processing for turbulent flows in the time and spectral domain

Module grade calculation

Grade of the module is the grade of the oral examination.

Workload

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

Literature

- C. Tropea, Handbook of Experimental Fluid Mechanics, Springer, Heidelberg, 2007
- M. Zlokarnik, Dimensional Analysis and Scale-up in Chemical Engineering, Springer, Berlin, 1991
- A. C. Eckbreth, Laser Diagnostics for Combustion Temperature and Species, Taylor & Francis Ltd, New York, 1996
- K. Kohse-Höinghaus, J. B. Jeffries, Applied Combustion Diagnostics, Taylor & Francis Ltd, New York, 2002
- H. W. Coleman, W. G. Steele, Experimentation and Uncertainty Analysis for Engineers, Wiley, New York, 1999

M**5.86 Module: Membrane Materials & Processes Research Masterclass [M-CIWVT-106529]**

Responsible: Prof. Dr. Andrea Iris Schäfer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)

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

Mandatory			
T-CIWVT-113153	Membrane Materials & Processes Research Masterclass	6 CR	Schäfer

Competence Certificate

Learning control is an examination of another type:

The exam will be composed of contributions during the course and an oral presentation during the full day workshop.

Prerequisites

None

Competence Goal

The student will learn basic skills in research at the example of membrane materials and processes applied to water treatment. The skills will assist in conducting research at master, PhD, or postdoctoral levels when background or training differ. Technical skills include the design of experiments to answer specific research questions, performance parameters through to data manipulation, validation, error estimation and interpretation, while the soft skills encompass health and safety aspects of experimental research, research communication (publication) and research integrity.

Content

The content teaches required knowledge to carry out research in the field, including formulation of a research problem and research questions, experimental design, data validation and storage, as well as presentation of research in spread sheets, graphs, schematics and communication in publications, oral & poster presentations.

Module grade calculation

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

Annotation

The course will be held at IAMT at Campus North (352, IAMT Seminar Room) and be integrated with ongoing research in an international environment. To carry out experimental work exam registration is required. Attendance is required for the completion of the module, in particular for the full day workshop.

Workload

- Lectures and Exercises: 60 hrs
- Self-study: 80 hrs
- Exam preparation: 40 hrs

Recommendation

The course assumes basic knowledge of membrane materials and processes applied to water treatment as well as the course on proposal writing. Those missing the relevant background are expected to read a textbook from the course recommended reading list or consult relevant materials on the proposal writing course.

M**5.87 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	Membrane Reactors	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**5.88 Module: Membrane Technologies in Water Treatment [M-CIWVT-105380]**

Responsible: Prof. Dr. Harald Horn
Dr.-Ing. Florencia Saravia

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Advanced Fundamentals \(BIW\)](#) (Usage from 4/1/2021)
[Technical Supplement Course](#) (Usage from 4/1/2020)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2020)
[Specialized Course I / Water Technology](#) (Usage from 4/1/2020)
[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2020)

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

Mandatory			
T-CIWVT-113235	Exercises: Membrane Technologies	1 CR	Horn, Saravia
T-CIWVT-113236	Membrane Technologies in Water Treatment	5 CR	Horn, Saravia

Competence Certificate

The learning control consists of two partial achievements:

- written examination lasting 90 minutes
- completed coursework (prerequisite for the written exam):
Submission of exercises, membrane design and short presentation (5 minutes, group work).

Prerequisites

None

Competence Goal

Students have a fundamental knowledge on membrane technology in water and waste water treatment. They learn how the different membrane systems (reverse osmosis, nanofiltration, ultrafiltration, microfiltration, and dialysis) have to be applied to produce a certain water quality. They are able to design such systems.

Content

- The solution-diffusion model
- Concentration polarization and the consequences for membrane module design.
- Membrane production and properties.
- Membrane configuration and design
- Membrane systems for desalination and brackish water treatment
- Membrane bio reactors for waste water treatment
- Biofouling, scaling and prevention of both
- Excursions with introduction: 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**5.89 Module: Microbiology for Engineers [M-CIWVT-104319]**

Responsible: Prof. Dr. Thomas Schwartz
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Water Technology](#)

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

Mandatory			
T-CIWVT-106834	Microbiology for Engineers	4 CR	Schwartz

Prerequisites

None

Workload

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

M**5.90 Module: Microfluidics [M-CIWVT-104350]**

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Mechanical Process Engineering](#)

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

Mandatory			
T-CIWVT-108909	Microfluidics	4 CR	Leneweit

Competence Certificate

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

Prerequisites

None

Competence Goal

Acquisition of capacities for the development of microfluidic systems and their investigation

Content

Definition of the term „microfluidics“, physics of miniaturization, scales in micro and nanofluidics, introduction to fabrication methods, fluid dynamics of microfluidic systems, basic equations of fluid mechanics, creeping flows, electrohydrodynamics of microsystems, electroosmosis, electrophoresis and DNA sequencing, diffusion, mixing and separation in microsystems, interfacial phenomena and multiphase flows in microsystems, digital microfluidics and microfluidic systems, Microfluidic production of mRNA lipid nanoparticles, process engineering research on advanced drug delivery systems

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

Skriptum zur Vorlesung

M**5.91 Module: Microfluidics and Case Studies [M-CIWVT-105205]**

Responsible: PD Dr. Gero Leneweit
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)
[Specialized Course I / Mechanical Process Engineering](#)

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

Mandatory			
T-CIWVT-108909	Microfluidics	4 CR	Leneweit
T-CIWVT-110549	Microfluidics - Case Studies	2 CR	Leneweit

Competence Certificate

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

Prerequisites

None

Competence Goal

Acquisition of capacities for the development of microfluidic systems and their investigation

Content

Definition of the term „microfluidics“, physics of miniaturization, scales in micro and nanofluidics, introduction to fabrication methods, fluid dynamics of microfluidic systems, basic equations of fluid mechanics, creeping flows, electrohydrodynamics of microsystems, electroosmosis, electrophoresis and DNA sequencing, diffusion, mixing and separation in microsystems, interfacial phenomena and multiphase flows in microsystems, digital microfluidics and microfluidic systems

Lab experiments: Preparation of nanoemulsions from aerosols in a micromixer; preparation and characterization of nanocapsules as drug delivery systems by nanofluidics.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 30 h
- Homework: 60 h
- Exam Preparation: 35 h
- Case Studies: 60 h

Literature

Skriptum zur Vorlesung

M**5.92 Module: Microrheology and High Frequency Rheology [M-CIWVT-104395]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)

Credits
2

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

Mandatory			
T-CIWVT-108977	Microrheology and High Frequency Rheology	2 CR	Oelschlaeger

Prerequisites

None

Workload

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

M**5.93 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 / Product Design](#) (Usage from 4/1/2020)
[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2020)

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

Mandatory			
T-CIWVT-110895	Mixing, Stirring, Agglomeration	6 CR	Rhein

Competence Certificate

Learning control is an oral individual examination with a duration of 30min according SPO section 4, subsection 2.

Prerequisites

None

Competence Goal

The students are able to explain the fundamental laws and the derived physical principles of mixing, stirring and the particle agglomeration and not only to relate them to the principally suited processes but also to selected apparatuses. They have the ability to apply the relationship between product, operation and design parameters to different processes. They can analyse the related process engineering problems with scientific methods and give alternative problem solution proposals. On the basis of their skills they can evaluate whether and if applicable a promising process can be designed.

Content

- Fundamentals and applications
- statistic methods to characterize the mixing quality
- characterisation of the flow properties of bulk solids and liquids
- introduction into dimension analysis to achieve characteristic numbers important for mixing problems
- scale-up procedures for specific mixing processes
- solids mixing processes like free-fall, pusher and intensive mixers, fluidised bed, air jet, and turnover mixers; pile mixing techniques
- fluid-mixing processes like homogenisation, suspending, emulsifying, gassing and heat transfer
- static mixers and kneaders
- adhesion forces between particles
- agglomerate properties: characterisation of agglomerates regarding size, size distribution, porosity, density, stability, flow behaviour and instantiation behavior
- agglomeration processes like roll-agglomeration, mixing agglomeration, fluidized bed and spray agglomeration, agglomeration in liquids by means of coagulation, flocculation or changed wettability, press agglomeration by means of tableting, roller compaction or extrusion and post hardening of agglomerates by means of sintering
- Introduction to modeling and simulation of mixing and agglomeration processes

Module grade calculation

The module grade ist the grade of oral examination.

Workload

Lectures: 3 SWS/ 45 h

Homework: 75 h

Exam preparation: 60 h

Total: 180 h

M**5.94 Module: Modeling Wastewater Treatment Processes [M-BGU-106113]**

Responsible: Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: [Technical Supplement Course](#) (Usage from 10/1/2022)

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

Mandatory			
T-BGU-112371	Modeling Wastewater Treatment Processes	6 CR	Azari Najaf Abad

Competence Certificate

- 'Teilleistung' T-BGU-112371 with examination of other type according to § 4 Par. 2 No. 3
 details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

The students will be able to learn the basics of wastewater treatment modeling to develop a matrix for a biological model. Another objective is being able to work with several relevant computer software as tools for modeling wastewater treatment processes and running sensitivity analysis, calibration, and validation. At the end of this course, the students will be able to apply the theory concerning modeling practice in case studies with real datasets using one of the relevant software they learned. During the presentation, they will discuss and explain the outcome of the model.

Content

The course deals with the basis of wastewater modeling (kinetics, stoichiometry, mass balances, hydraulics, mixing, and matrix notation), an introduction of existing activated sludge models (ASM1, ASM2, ASM3, ASM2d), and a selection of computer programs (AQUASIM, SIMBA, GPS-X, and SUMO) in which the models can be built in and the protocol for the development of calibrated activated sludge models will be practiced. Different adjustments to basic ASM models for characterization of biofilm and granular sludge model, as well as anaerobic digestion models (ADM), will be also discussed. Besides the presentations, exercises form a part of the course. Finally, case studies with real datasets on modeling wastewater treatment plants will be practiced.

Module grade calculation

grade of the module is grade of the exam

Annotation

The number of participants in the course is limited to 20 persons. The registration is made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- preparation of report and presentation (examination): 60 h

total: 180 h

Recommendation

Vorkenntnisse in Siedlungswasserwirtschaft, Modul 'Urban Water Infrastructure and Management'

Literature

Chen, G.H., van Loosdrecht, M.C., Ekama, G.A. and Brdjanovic, D. eds., 2020. Biological wastewater treatment: principles, modeling and design. IWA publishing.

Makinia, J. and Zaborowska, E., 2020. Mathematical modelling and computer simulation of activated sludge systems. IWA publishing.

Mannina, G. ed., 2017. Frontiers in Wastewater Treatment and Modelling: FICWTM 2017 (Vol. 4). Springer.

M**5.95 Module: Modelling and Simulation of Electrochemical Systems [M-ETIT-100508]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [Specialized Course I / New Bio-Production Systems - Electro-Biotechnology](#) (Usage from 4/1/2023)**Credits**
3**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

Mandatory			
T-ETIT-100781	Modelling and Simulation of Electrochemical Systems	3 CR	Weber

Prerequisites

none

M**5.96 Module: Module Master's Thesis [M-CIWVT-104526]**

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Master's Thesis](#)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	Grade to a tenth	Each term	1 term	German/English	5	4

Mandatory			
T-CIWVT-109275	Master's Thesis	30 CR	Rauch

Prerequisites

Process Technology and at least three further modules of the advanced fundamentals has to be passed. The internship has to be passed. The examination board decides on exceptions.

(Compare SPO section 14 subsection 1)

Modeled Conditions

The following conditions have to be fulfilled:

- You have to fulfill 3 of 11 conditions:
 - The module [M-CIWVT-103064 - Selected Formulation Technologies](#) must have been passed.
 - The module [M-CIWVT-104384 - Biotechnological Production](#) must have been passed.
 - The module [M-CIWVT-103065 - Biopharmaceutical Purification Processes](#) must have been passed.
 - The module [M-CIWVT-103072 - Computational Fluid Dynamics](#) must have been passed.
 - The module [M-CHEMBIO-104486 - Physical Chemistry \(incl. Lab\)](#) must have been passed.
 - The module [M-CIWVT-103058 - Thermodynamics III](#) must have been passed.
 - The module [M-CIWVT-104383 - Kinetics and Catalysis](#) must have been passed.
 - The module [M-CIWVT-104378 - Particle Technology](#) must have been passed.
 - The module [M-CIWVT-104377 - Thermal Transport Processes](#) must have been passed.
 - The module [M-CIWVT-105380 - Membrane Technologies in Water Treatment](#) must have been passed.
 - The module [M-CIWVT-106297 - Bioprocess Development](#) must have been passed.
- The module [M-CIWVT-104374 - Process Technology](#) must have been passed.
- The module [M-CIWVT-104527 - Internship](#) must have been passed.

Workload

Homework: 900 h

M**5.97 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](#)
[Specialized Course I / Product Design](#)

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

Mandatory			
T-CIWVT-108894	Nanoparticles – Structure and Function	6 CR	Meyer

Competence Certificate

The examination is an oral examination with a duration of about 30 minutes in case of a single module examination and 20 minutes in case of a overall examination of the specialized course (section 4 subsection 2 number 2 SPO).

Prerequisites

None

Competence Goal

Students develop an understanding of the correlation between structure of nanoscaled systems and their physical properties. Additionally, they understand how process parameters in the synthesis of nanoscaled particle systems determine the resulting particle structure.

Based on the knowledge of the structure-function-relationships and of the synthesis routes, the students can develop strategies for the systematic generation and optimization of nanoparticulate systems for specific applications.

Content

- Technical and historical classification of the lecture content
- Methods for visualization of nanoscaled objects and structures
- Description and physical basis of specific properties of nanoscaled particles (and other structures / shapes)
 - Size dependency of surface energy
 - Modification of the phase transition temperature (compared to the bulk phase)
 - Mechanical properties
 - Optical properties
 - electrical properties
- Methods for synthesizing nanoscaled particle systems in the gas phase with well-defined properties
- Relevant process parameters for the adjustment of
 - Particle size (primary particle and agglomerate size)
 - Agglomeration state
 - Agglomerate strength
 - Structure / phase of the particle material
 - Chemical structure of particle surface
 - Multi-level structuring (core-shell, nanoparticles on support structures)

Module grade calculation

The module grade ist the grade of oral examination.

Workload

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

M**5.98 Module: NMR for Engineers [M-CIWVT-104401]**

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

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

Mandatory			
T-CIWVT-108984	NMR for Engineers	4 CR	Guthausen
T-CIWVT-109144	Laboratory Work for NMR for Engineers	2 CR	Guthausen

Prerequisites

None

Competence Goal

Knowledge about NMR and their applications, basic understanding of the phenomena

Content

An overview of applications of nuclear magnetic resonance (NMR) will be given together with the basic description of this analytical tool. In the focus of the lectures are typical applications of NMR in chemical and bio engineering. The understanding of this versatile analytical method will be developed on the basis of dedicated examples.

Workload

- Attendance time (Lecture): 30 h
- Revision course: 30 h
- Internship: Attendance Time 30 h, Preparation Time 30 h
- Exam Preparation: 60 h

Literature

Lehrbücher Kimmich und Callaghan, weitere Literatur wird jeweils in der Vorlesung angegeben.

M**5.99 Module: NMR Methods for Product and Process Analysis [M-CIWVT-105890]****Responsible:** apl. Prof. Dr. Gisela Guthausen**Organisation:** KIT Department of Chemical and Process Engineering

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

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

Mandatory			
T-CIWVT-111843	NMR Methods for Product and Process Analysis	4 CR	Guthausen

Prerequisites

None

Competence Goal

Knowledge about NMR and their applications, basic understanding of the phenomena.

Content

An overview of applications of nuclear magnetic resonance (NMR) will be given together with the basic description of this analytical tool. In the focus of the lectures are typical applications of NMR in chemical and bio engineering. The understanding of this versatile analytical method will be developed on the basis of dedicated examples.

Module grade calculation

The module grade ist the grade of the oral examination.

Workload

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

Literature

Lehrbücher Kimmich und Callaghan, weitere Literatur wird jeweils in der Vorlesung angegeben.

M**5.100 Module: Nonlinear Process Control [M-CIWVT-106316]**

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

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

Mandatory			
T-CIWVT-112824	Nonlinear Process Control	6 CR	Meurer

Competence Certificate

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

Prerequisites

None

Content

Nonlinearities are ubiquitous in nature. Differing from linear control theory and linear control systems, which typically rely on the local linearization of a nonlinear system around some equilibrium, this module addresses nonlinear concepts for the analysis and the control of nonlinear systems. The course covers the following topics:

- Introduction to the dynamic analysis of nonlinear systems
- Differential geometric concepts
- Exact feedback linearization
- Differential flatness and flatness-based feedforward and tracking control
- Lyapunov theory and Lyapunov-based design methods

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

Module grade calculation

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

Annotation

If required, the course will be offered in English.

Workload

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

Self-study: 75 hrs.

Exam preparation: 60 hrs.

Literature

- T. Meurer: Nonlinear Process Control, Lecture Notes.
- B. Brogliato, R. Lozano, B. Maschke, O. Egeland: Dissipative systems analysis and control, Springer, 2007.
- H. Nijmeijer, A.J. van der Schaft: Nonlinear Dynamical Control Systems. Springer, 1991.
- Isidori: Nonlinear Control Systems. Springer-Verlag, 1995.
- H. K. Khalil: Nonlinear Systems, Prentice Hall, 2002.
- M. Krstic, I. Kanellakopoulos, P. Kokotovic: Nonlinear and Adaptive Control Design, John Wiley & Sons, 1995.
- S. Sastry: Nonlinear Systems, Analysis, Stability, Control. Springer-Verlag, 1999.
- A. J. van der Schaft: L2-gain and passivity techniques in nonlinear control, Springer, 2016.
- M. Vidyasagar: Nonlinear Systems Analysis, SIAM, 2002.



5.101 Module: Numerical Methods in Fluid Mechanics [M-MATH-102932]

Responsible: Prof. Dr. Willy Dörfler
PD Dr. Gudrun Thäter

Organisation: KIT Department of Mathematics

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

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

Mandatory			
T-MATH-105902	Numerical Methods in Fluid Mechanics	4 CR	Dörfler, Thäter

Competence Certificate

Oral exam of about 20 minutes.

Prerequisites

None

Competence Goal

Participants know about the modelling and physical basics that lead to the model equations. They know how to discretize fluidmechanical problems with the finite element method and know especially how to treat the incompressibility condition. They are able to analyze stability and convergence of the presented methods.

Content

- Modelling and derivation of the Navier-Stokes equations
- Mathematical and physical representation of energy and stress
- Lax-Milgram theorem, Céa lemma and saddle point theory
- Analytical and numerical treatment of the potential and Stokes flow
- Stability and convergence of the discrete models
- Numerical treatment of the stationary nonlinear equation
- Numerical treatment of the instationary problems
- Applications

Module grade calculation

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

Workload

Total workload: 120 hours

Attendance: 45 h

- lectures, problem classes and examination.

Self studies: 75 h

- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination.

Recommendation

Basic knowledge in the numerical treatment of differential equations, such as boundary value problems or initial value problems is strongly recommended. Knowledge in functional analysis is recommended.

M**5.102 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)

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

Mandatory			
T-CIWVT-113232	Numerical Simulation of Reacting Multiphase Flows - Prerequisite	6 CR	Stein
T-CIWVT-113233	Numerical Simulation of Reacting Multiphase Flows	2 CR	Stein

Competence Certificate

The learning control consists of two partial achievements:

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

Prerequisites

The completed coursework is a prerequisite for participation in the oral examination.

Competence Goal

Course participants can explain basic and advanced concepts related to the modelling and simulation of reacting multiphase flows. They are knowledgeable of the governing equations of both single and multiphase flows and can describe the physical meaning of all terms in these equations. They can explain the fundamentals of turbulence and turbulence modelling, chemical conversion and multiphase flow modelling. They are knowledgeable of numerical approximation and solution methods for reacting multiphase flows and know how to apply them. In the related tutorials with the OpenFOAM software, they have obtained a first practical experience in setting up, running and analysing their simulations and are capable of applying the obtained knowledge to further simulation tasks.

Content

- Basics of computational fluid dynamics
- Governing equations, turbulence & turbulence modelling
- Chemical conversion and reacting flows
- Non-reacting and reacting multiphase flows
- Numerical approximation and solution methods

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

The OpenFOAM tutorials will be conducted on the students' laptops. All course material is provided in English, while the lecture will be held in German.

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**5.103 Module: Optimal and Model Predictive Control [M-CIWVT-106317]**

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

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

Mandatory			
T-CIWVT-112825	Optimal and Model Predictive Control	6 CR	Meurer

Competence Certificate

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

Prerequisites

none

Competence Goal

Informationen folgen

Content

Many problems in industry and economy rely on the determination of an optimal solution satisfying desired performance criteria and constraints. In mathematical terms this leads to the formulation of an optimization problem. Here it is in general distinguished between static and dynamic optimization with the latter involving a dynamical process. This lecture gives an introduction to the mathematical analysis and numerical solution of dynamic optimization problems with a particular focus on optimal control and model predictive control. The lecture addresses the following topics:

- Fundamentals of dynamic optimization problems
- Dynamic optimization without and with constraints
- Linear and nonlinear model predictive control
- Numerical methods

Selected examples are considered and solved in the exercises and dedicated computer exercises.

Module grade calculation

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

Workload

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

Self-study: 60 hrs.

Exam preparation: 75 hrs.

Literature

- T. Meurer: Optimal and Model Predictive Control, Lecture Notes.
- D. G. Luenberger, Y. Ye: Linear and Nonlinear Programming, Springer, 2008.
- J. Nocedal, S.J. Wright: Numerical Optimization, Springer, 2006.
- M. Papageorgiou, M. Leibold, M. Buss: Optimierung, Springer, 2012.
- E. Camacho, C. Alba: Model Predictive Control, Springer, 2004
- L. Grüne, J. Pannek: Nonlinear Model Predictive Control: Theory and Algorithms, Springer, 2011.
- L. Wang: Model Predictive Control System Design and Implementation Using MATLAB, Springer, 2009.

M**5.104 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: $15 \cdot 2h = 30h$
2. Pre- and postprocessing time Lecture: $15 \cdot 3h = 45h$
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**5.105 Module: Particle Technology [M-CIWVT-104378]**

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

Credits
6

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

Mandatory			
T-CIWVT-106028	Particle Technology Exam	6 CR	Dittler

Competence Certificate

Learning control is a written examination lasting 120 minutes.

Prerequisites

None

Competence Goal

Students develop an advanced understanding of properties & behavior of particles and particulate systems in important engineering applications; they are able to use this understanding for calculations and design of selected processes

Content

Description and behavior of particles and particulate systems in engineering applications; selected unit operations in particle technology.

Module grade calculation

The module grade ist the grade of the written exam.

Workload

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

M**5.106 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	Physical Chemistry (Written Exam)	4 CR	Kubar, Meier
T-CHEMBIO-109179	Physical Chemistry (Lab)	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**5.107 Module: Physical Foundations of Cryogenics [M-CIWVT-103068]**

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

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

Mandatory			
T-CIWVT-106103	Physical Foundations of Cryogenics	6 CR	Grohmann

Competence Certificate

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

Prerequisites

None

Competence Goal

Understanding of the mechanisms of entropy generation, and the interaction of the first and the second law in thermodynamic cycles; understanding of cryogenic material properties; application, analysis and assessment of real gas models for classical helium I; understanding of quantum fluid properties of helium II based on Bose-Einstein condensation, understanding of cooling principles at lowest temperatures.

Content

Relation between energy and temperature, energy transformation on microscopic and on macroscopic scales, physical definitions of entropy and temperature, thermodynamic equilibria, reversibility of thermodynamic cycles, helium as classical and as quantum fluid, low-temperature material properties, cooling methods at temperatures below 1 K.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

Schroeder, D.V.: An introduction to thermal physics. Addison Wesley Longman (2000)
 Pobell, F.: Matter and methods at low temperatures. 3rd edition, Springer (2007)

M**5.108 Module: Power-to-X – Key Technology for the Energy Transition [M-CIWVT-105891]**

Responsible: Prof. Dr.-Ing. Roland Dittmeyer
Dr. Peter Holtappels

Organisation: KIT Department of Chemical and Process Engineering

Part of: **Technical Supplement Course** (Usage from 4/1/2022)

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

Mandatory			
T-CIWVT-111841	Power-to-X – Key Technology for the Energy Transition	4 CR	Dittmeyer, Holtappels
T-CIWVT-111842	Practical in Power-to-X: Key Technology for the Energy Transition	2 CR	Dittmeyer, Holtappels

Competence Certificate

The learning control consists of two partial achievements:

1. Lab, completed coursework
2. Oral examination lastin approx. 30 minutes

Competence Goal

The students are familiar with the rationale and the basic concepts of Power-to-X conversion. They know the major routes and individual components and what can be expected in terms of performance metrics both on component and process level. They have developed a basic understanding of water and steam electrolysis as well as of plasma splitting of carbon dioxide. Moreover, they had a first encounter with real container plants for electrolysis and fuel synthesis in the Energy Lab 2.0 as well as modular setups for plasma splitting, fuel synthesis and fuel upgrading.

Content

The module will provide an introduction to Power-to-X technologies which are expected to play a major role in the future energy system. The rationale for converting renewable electrical energy into fuels and chemicals will be explained and substantiated with data from relevant studies. Concepts for central and distributed Power-to-X facilities will be described with a focus on modular technologies for distributed production. Different options for water and steam electrolysis as well as selective electrochemical reduction of carbon dioxide will be discussed with a view to technology readiness level, energy efficiency, and cost. The alternative concept of plasma-based activation of inert molecules will be introduced and the status of this technology will be assessed and compared to electrolysis. Basic process layouts for production of synthetic methane, liquid hydrocarbons, methanol and ammonia from renewable electrical energy, carbon dioxide and water will be described and assessed in terms of material and energy flows and options for process integration. Moreover, concepts for offshore Power-to-X production will be explained and current research in this area will be highlighted. Finally, industrial project initiatives in the field of Power-to-X will be presented and discussed. The practical will cover four days and will be done in larger groups of up to 15 persons. Participants will be introduced to the containerized Power-to-Liquid Plant and its infrastructure in the Energy Lab 2.0 at KIT Campus North. They will work at this site with a containerized water electrolyzer and steam electrolyzer for hydrogen production. Moreover, the group will be made familiar with an experimental setup for plasma splitting of carbon dioxide in the plasma lab jointly operated by IMVT and IHM and with the synthesis and upgrading of Fischer-Tropsch-Fuels in the synfuel lab at IMVT.

Module grade calculation

The module grade is the grade of the oral exam.

Annotation

Practical course: Dates by arrangement, Location: IMVT, KIT Campus Nord, Energy Lab 2.0, Building 605.

Workload

- Attendance time:
lecture: 30 h,
lab: 16 h (4 dates)
- Self-study: 90 h
- Exam preparation: 45 h

Literature

Florian Ausfelder, Hannah Dura, 3. Roadmap des Kopernikus-Projektes P2X Phase II, OPTIONEN FÜR EIN NACHHALTIGES ENERGIE- SYSTEM MIT POWER-TO-X- TECHNOLOGIEN, Transformation – Anwendungen – Potenziale, 2021 (https://www.kopernikus-projekte.de/aktuelles/news/p2x_roadmap_3_0)

M**5.109 Module: Practical Course Combustion Technology [M-CIWVT-104321]**

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

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

Mandatory			
T-CIWVT-108873	Practical Course Combustion Technology	4 CR	Harth

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are able to analyze results of combustion experiments and to assess the measurements methods.

Content

The laminar flame speed is experimentally determined, stability limits of combustion systems are investigated and the process of combustion is analyzed. Different measurement techniques (e.g. exhaust gas probes or optical measurement techniques) are applied.

Annotation

Dates of experiments by arrangement. Please contact the responsible person (stefan.harth@kit.edu) for registration by May the 15th by the latest.

If necessary, the course will be held in English.

Workload

- Experiments: 30 h (3 - 4 experiments depending on the complexity of the used test stands)
- Homework, test records: 50 h
- Exam preparation: 40 h

M**5.110 Module: Practical Course in Water Technology [M-CIWWT-103440]**

Responsible: Dr. Gudrun Abbt-Braun
Dr. Andrea Hille-Reichel
Prof. Dr. Harald Horn

Organisation: KIT Department of Chemical and Process Engineering

Part of: **Technical Supplement Course**
Specialized Course I / Water Technology (Usage from 10/1/2019)

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

Mandatory			
T-CIWWT-106840	Practical Course in Water Technology	3 CR	Abbt-Braun, Hille-Reichel, Horn
T-CIWWT-110866	Excursions: Water Supply	1 CR	Abbt-Braun, 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**5.111 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](#)
[Specialized Course I / Product Design](#)

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

Mandatory			
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell

Competence Certificate

Learning control is an oral examination with a duration of about 25 minutes, SPO section 4 subsection 2.

Prerequisites

None

Competence Goal

The students know the basics of characterization of powders, pastes and suspensions. They have a fundamental understanding of the process technology for shaping of particulate systems. They are able to use these fundamentals to design selected wet- and dry forming processes.

Content

The course covers fundamentals of the process technology for shaping of ceramic or metal particle systems. Important shaping methods are reviewed. The focus is on characterization and properties of particulate systems, and, in particular, on process technology for shaping of powders, pastes, and suspensions.

Module grade calculation

Module grade is the grade of oral examination.

Workload

- Attendance Time: 30 h
- Homework: 45 h
- Exam preparation: 45 h

Recommendation

Knowledge of general material science is required.

Literature

- Folien zur Vorlesung: verfügbar unter <http://ilias.studium.kit.edu>
- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Ceramic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- Schatt ; K.-P. Wieters ; B. Kieback. „Pulvermetallurgie: Technologien und Werkstoffe“, Springer, 2007
- R.M. German. “Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- Thümmel, R. Oberacker. “Introduction to Powder Metallurgy”, Institute of Materials, 1993

M**5.112 Module: Principles of Constrained Static Optimization [M-CIWVT-106313]**

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Automation and Process Systems Engineering](#) (Usage from 10/1/2023)

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

Mandatory			
T-CIWVT-112811	Principles of Constrained Static Optimization	4 CR	Jerono, Meurer

Competence Certificate

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

Prerequisites

None

Content

Optimization problems arise in a broad variety in different scientific and engineering domains ranging from the fit of parameter based on a performance criterion to finding extreme values of an objective function and further extending to machine learning applications. While dynamic optimization (addressed on the module M-CIWVT-106317) involves dynamical systems in static optimization the minimization (maximization) of functions subject to equality and inequality constraints is considered. This module gives an introduction to the mathematical analysis and numerical solution of unconstrained and constrained static optimization problems. The lecture addresses the following topics:

- Fundamentals of static optimization problems
- Unconstrained static optimization
- Constrained static optimization
- Numerical methods

Selected examples are considered and solved in the exercises and dedicated computer exercises.

Module grade calculation

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

Workload

Attendance time: Lectures: 15 hrs. exercises: 15 hrs.

Self-study: 50 hrs.

Exam preparation: 40 hrs.

M**5.113 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**5.114 Module: Process Analysis: Modeling, Data Mining, Machine Learning [M-ETIT-105594]**

Responsible: Prof. Dr.-Ing. Michael Heizmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: [Technical Supplement Course](#) (Usage from 10/1/2022)
[Specialized Course I / Automation and Process Systems Engineering](#)

Credits
4

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
2

Mandatory			
T-ETIT-111214	Process Analysis: Modeling, Data Mining, Machine Learning	4 CR	Borchert, Heizmann

Prerequisites

none

Module grade calculation

Die Modulnote ist die Note der mündlichen Prüfung.

M**5.115 Module: Process and Plant Safety [M-CIWVT-104352]**

Responsible: Hon.-Prof. Dr. Jürgen Schmidt
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Fuel Technology](#)
[Specialized Course I / Energy Process Engineering](#)
[Specialized Course I / Environmental Process Engineering](#)
[Specialized Course I / Thermal Process Engineering](#)

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

Mandatory			
T-CIWVT-108912	Process and Plant Safety	4 CR	Schmidt

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

The students are able to systematically assess the risks of technical systems, assess the effects of possible accidents and define suitable safety measures. The lecture is divided into thematic blocks. Lecture block 01 is an introduction to the topic:

Lecture blocks

1. Introduction
2. risk management
3. hazardous substances
4. Exothermic Chemical Reactions
5. safety devices
6. effluent systems
7. Dispersion of hazardous substances
8. PLT protective devices
9. explosion protection
10. electrostatics

Content

Introduction to safeguarding processes and plants to protect people and the environment from potential hazards of technical plants in the chemical, petrochemical, pharmaceutical and oil and gas sectors. Risk management can be used to prevent incidents and limit the impact of events. This includes topics such as technical safety of plants, risk management, prevention of hazards from substances and dangerous chemical reactions, design of protective devices for emergency relief such as safety valves, bursting discs and downstream containment devices. Modern process control systems, emission and dispersion of hazardous substances in the atmosphere, and explosion and fire protection.

Workload

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

M**5.116 Module: Process Development in the Chemical Industry [M-CIWVT-104389]**

Responsible: Hon.-Prof. Dr. Jürgen Dahlhaus
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Additional Examinations](#)

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

Mandatory			
T-CIWVT-108961	Process Development in the Chemical Industry	2 CR	Dahlhaus

Prerequisites

None

M**5.117 Module: Process Engineering for the Production of Food from Animal Origins [M-CIWVT-106699]****Responsible:** PD Dr. Volker Gaukel**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#)[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2024)[Specialized Course I / Bioresource Engineering](#) (Usage from 4/1/2024)

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

Mandatory			
T-CIWVT-113477	Process Engineering for the Production of Food from Animal Origins	4 CR	Gaukel

Competence Certificate

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

Prerequisites

None

Competence Goal

Students understand and are able to explain conventional methods for producing foods, even complex ones, from animals. They know unit operations of relevance, both conventional and innovative approaches. They are able to design the processes according to raw material specifics. They identify correlations between process parameters and quality-determining properties of food. They are also able to transfer process knowledge between individual product groups. They know essential aspects required to assess sustainability and energy aspects of the individual process steps and complete process chains.

Students are able to apply principles of product design. This involves identifying the relationships between process parameters and the structure of a food product (process function) as well as between the inner structure of foods and their properties (property function). Based on this, they are able to analyze and solve problems in the field of food process engineering.

Students are able to use their knowledge to evaluate a process unit with regard to food production, involving aspects such as sustainability, energy efficiency, food safety and expected product quality.

Module grade calculation

Grade of the module is the grade of oral examination.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 30 h

Literature

- Vorlesungsfolien & Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)
- H.P. Schuchmann und H. Schuchmann: Lebensmittelverfahrenstechnik: Rohstoffe, Prozesse, Produkte; Wiley VCH, 2005; ISBN: 978-3-527-66054-4 (auch als ebook)
- H.G. Kessler: Lebensmittel- und Bioverfahrenstechnik – Molkereitechnologie, Verlag A. Kessler, 1996, ISBN 3-9802378-4-2
- H.G. Kessler: Food and Bio Process Engineering - Dairy Technology, Publishing House A. Kessler, 2002, ISBN 3-9802378-5-0
- M. Loncin: Die Grundlagen der Verfahrenstechnik in der Lebensmittelindustrie; Aarau Verlag, 1969, ISBN 978-3794107209

M**5.118 Module: Process Engineering for the Production of Food from Plant-Based Raw Materials [M-CIWVT-106698]****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 winter term	1 term	German	4	1

Mandatory			
T-CIWVT-113476	Process Engineering for the Production of Food from Plant-Based Raw Materials	4 CR	Gaukel

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**5.119 Module: Process Engineering in Wastewater Treatment [M-BGU-103399]****Responsible:** Dr.-Ing. Tobias Morck**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences**Part of:** [Technical Supplement Course](#)

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

Mandatory			
T-BGU-106787	Process Engineering in Wastewater Treatment	6 CR	Morck

Competence Certificate

- 'Teilleistung' T-BGU-106787 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

Students acquire knowledge about typical techniques in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs. Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content

Municipal Wastewater Treatment: Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany. Following processes are covered:

- different activated sludge processes
- anaerobic technologies and energy-recovery systems
- filtration technologies
- wastewater disinfection and pathogen removal
- chemical and biological phosphorus removal
- micro-pollutants removal
- resource management and energy efficiency

International Sanitary Engineering: Students get acquainted with the design and operation used for wastewater treatment at international level. They analyze, evaluate and take decisions when new and more holistic oriented methods can be implemented. Following topics are covered:

- activated sludge processes
- trickling filters and rotating biological contactors
- treatment ponds
- retention soil filter / Wetlands
- UASB/EGSB/Anaerobic filter
- decentralized versus centralized systems
- material flow separation
- energy-recovery from wastewater
- drinking water purification
- waste management

Module grade calculation

grade of the module is grade of the exam

Annotation**IMPORTANT:**

The module will not be offered anymore as from summer term 2019. It will be replaced by the module Wastewater Treatment Technologies.

group presentation and written report is internal examination prerequisite.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Municipal Wastewater Treatment lecture/exercise: 30 h
- International Sanitary Engineering lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Municipal Wastewater Treatment: 30 h
- preparation and follow-up lecture/exercises International Sanitary Engineering: 30 h
- examination preparation: 60 h

total: 180 h

Recommendation

module 'Urban Water Infrastructure and Management'

Literature

Imhoff, K. u. K.R. (1999) Taschenbuch der Stadtentwässerung, 29. Aufl., Oldenbourg Verlag, München, Wien
ATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, Berlin
ATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn, Berlin
Sperling, M.; Charnicaro, C.A.L. (2005) Biological wastewater treatment in warm climate regions, IWA publishing, London
Wilderer, P.A., Schroeder, E.D. and Kopp, H. (2004) Global Sustainability - The Impact of Local Cultures. A New Perspective for Science and Engineering, Economics and Politics WILEY-VCH

M**5.120 Module: Process Instruments and Machinery and Their Process Integration [M-CIWVT-104351]**

Responsible: Manfred Nagel
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)

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

Mandatory			
T-CIWVT-108910	Process Instruments and Machinery and Their Process Integration	4 CR	Nagel

Competence Certificate

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

Prerequisites

None

Competence Goal

Skills to develop holistic processes for product design. Knowledge about task of engineers in process industry.

Content

Teaching of methods and creating awareness about boundary conditions related to scientific and systematic engineering approaches in process development. In Bachelorstudies and during basic studies in process technology focus was laid on the description/analysis of different physical phenomena. Their linkage in the course of selection, dimensioning, interconnection and optimization of apparatuses/ machines and their integration during process development will be outlined and illustrated by a variety of real-life examples.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.121 Module: Process Modeling in Downstream Processing [M-CIWVT-103066]**

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

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

Mandatory			
T-CIWVT-106101	Process Modeling in Downstream Processing	4 CR	Franzreb

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are able to sum up and explain equilibrium and kinetic equations relevant for chromatography modeling. They are able to explain the methods used for determination of equilibrium and kinetic parameters and can discuss examples. They are familiar with the principle of complex downstream processes, e.g. simulated moving beds, and can explain the differences to conventional chromatography. Using commercial software they are able to simulate chromatography processes and to analyze the results. On this basis they can optimize process parameters and fit them in order to meet given targets such as purity or yield. They can evaluate different processes and choose the variant for a given task.

Content

Fundamentals and practical examples of chromatography modeling,
 Design rules for Simulated Moving Beds, Design of Experiments (DOE)

Workload

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

M**5.122 Module: Process Technology [M-CIWVT-104374]**

Responsible: Prof. Dr.-Ing. Thomas Kolb
Organisation: KIT Department of Chemical and Process Engineering
Part of: **Advanced Fundamentals (mandatory)**
Technical Supplement Course

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

Mandatory			
T-CIWVT-106148	Practical Course Process Technology and Plant Design	0 CR	Kolb
T-CIWVT-106149	Initial Exam Process Technology and Plant Design	0 CR	Kolb
T-CIWVT-106150	Process Technology and Plant Design Written Exam	8 CR	Kolb

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**5.123 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	Processes and Process Chains for Renewable Resources	6 CR	Dahmen, Sauer

Competence Certificate

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

Prerequisites

None

Competence Goal

The students become able to:

- understand and assess the technical background of the key elements of process chains for the utilization of renewable resources,
- build up the ability for the development of process chains from biomass production via the conversion processes up to product design,
- apply the lessons learned to develop closed process chains for sustainable production of, as example, platform chemicals or material from renewable resources.

Content

The course comprises the following contents:

- Introduction to building a common knowledge base, among others the presentation of today's most important utilization pathway for biomass, biomass potentials, future usage scenarios,
- Essential technical fundamentals for biomass processing. The focus is on the use of lignocellulosic biomass. Procedures for pretreatment, biomass decomposition and separation as well as for conversion of the respective fractions are learned,
- Systematics and analysis of process chains with renewable raw materials based on already established processes such as paper or sugar mills. Extension of the concepts to possible future biorefineries,
- In the exercise, parallel to the lecture, the learned will be applied and implemented by development of an exemplary biorefinery. The results will be presented in a seminar.

Module grade calculation

The grade of the oral examination is the module grade.

M**5.124 Module: Processing of Nanostructured Particles [M-CIWVT-103073]**

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

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

Mandatory			
T-CIWVT-106107	Processing of Nanostructured Particles	6 CR	Nirschl

Competence Certificate

Learning control is an oral examination lasting approx. 25 minutes.

Prerequisites

None

Competence Goal

Ability to design a process technology for the manufacturing and production of nanoscale particles

Content

Development of technical process in particle engineering; particle characterisation, interface engineering, particle synthesis;
 Typical processes: grinding, mixing, granulation, selective separation,
 classifying; fundamentals of apparatus and devices; simulation techniques, simulation tools

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

Skriptum zur Vorlesung

M**5.125 Module: Product Design II [M-CIWVT-104396]**

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Product Design](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108979	Product Design II	4 CR	Kind

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students have gathered insight into their role and professional tasks during industrial product design.

Content

Continuous product innovation is decisive for the competitiveness of companies. The module introduces to the principle of “conceptual product design”. The principle will be explained by lecturing, by exercising and by viewing and discussing a truly instructive movie on the topic. The understanding of the principle is deepened on the subjects of “crystallization” and “colloidal systems”. The principle of “conceptual product design” comprises on the one hand the notion of a “process function”, which is the functional relation between process parameters and physico-chemical product properties, and on the other hand the notion of a “property function”, which is the functional relation between these properties and the product quality.

Workload

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

Literature

- Product Design and Engineering – Best Practices (Ed. U. Bröckel, W. Meier, G. Wagner); Wiley VCH; Weinheim 2007; Vol. 1: Basics and Technologies; Vol. 2: Rawmaterials, Additives and Applications
- Product Design and Engineering – Formulation of Gels and Pastes (Ed. U. Bröckel, W. Meier, G. Wagner); Wiley VCH; Weinheim 2013
- Weitere Vorlesungsbegleitende Unterlagen werden durch jeweilige Dozenten bereitgestellt

M**5.126 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**5.127 Module: Production and Development of Cancer Therapeutics [M-CIWVT-106563]****Responsible:** PD Dr. Gero Leneweit**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 10/1/2023)
[Specialized Course I / Biopharmaceutical Process Engineering](#) (Usage from 10/1/2023)

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

Mandatory			
T-CIWVT-113230	Production and Development of Cancer Therapeutics	4 CR	Leneweit

Competence Certificate

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

Prerequisites

None

Competence Goal

Students acquire skills to autonomously analyse the product requirements of active substances and drug formulations and to independently plan and realise manufacturing technologies for drug substances and carrier systems.

Content

- Risk factors and stages of carcinogenesis
- therapeutic targets
- mechanisms of chemotherapies, immunotherapies, DNA and RNA therapies
- mechanisms of therapy resistance and overcoming strategies
- drug delivery systems and manufacturing technologies
- scaling; drug loading and coating
- industrial processes
- targeted cancer therapies
- receptors and ligands
- drug accumulation
- (pre-) clinical testing
- regulatory and economic aspects
- innovation potentials and application perspectives

Module grade calculation

The module grade 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**5.128 Module: Reaction Kinetics [M-CIWVT-104283]****Responsible:** Dr.-Ing. Steffen Peter Müller**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage until 9/30/2024)[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	Reaction Kinetics	6 CR	Müller

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to discuss the cause and the differing elementary steps of homogen reactions, and they are qualified to calculate rate coefficients from experimental studies/data. Because of various examples, students can identify and analyse reactions by different elementary steps and they are capable to evaluate homogen reactions critically.

Content

Basics: transition state theory, thermodynamics and the relationship to kinetics, active sites and chain reactions.

Application: photochemistry, reactions in solution, polyreactions, autocatalysis and explosions.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 34 h
- Homework: 16 h
- Exam Preparation: 130 h

M

5.129 Module: Reactor Modeling with CFD [M-CIWVT-106537]**Responsible:** Prof. Dr.-Ing. Gregor Wehinger**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2024)
[Specialized Course I / Chemical Process Engineering](#) (Usage from 4/1/2024)**Credits**
4**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
English**Level**
4**Version**
1

Mandatory			
T-CIWVT-113224	Reactor Modeling with CFD	4 CR	Wehinger

Competence Certificate

Learning control is an examination of another type: presentation and term paper.

Prerequisites

None

Competence Goal

The students are able to

- describe and apply the mathematical and physical principles of computational fluid dynamics (CFD),
- use the commercial CFD software STAR-CCM+ independently and thoroughly (preprocessing, solving, postprocessing),
- develop a CFD reactor model for an unknown chemical process engineering problem and investigate alternative reactor designs based on this model,
- analyze and evaluate the results obtained, also using virtual reality (VR),
- identify and evaluate errors and uncertainties in CFD models,
- visualize, present, and critically discuss their CFD results in the form of a final report.

Content

1. Conservation laws for momentum, mass and energy
2. The Finite-Volume-Method, solution algorithms, and boundary conditions
3. Computational meshes
4. CFD- Modelling of chemical reactors
5. Use of virtual reality in CFD
6. Basics of writing a scientific paper

Module grade calculation

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

Workload

- Attendance time: 45 h
- Self-study: 45 h
- Exam preparation: 30 h

Literature

- 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**5.130 Module: Refinery Technology - Liquid Fuels [M-CIWVT-104291]**

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

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

Mandatory			
T-CIWVT-108831	Refinery Technology - Liquid Fuels	6 CR	Rauch

Competence Certificate

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

Prerequisites

None

Competence Goal

The students are enabled to balance modern processes for the production of liquid fuels and to put them into context of a modern refinery. This knowledge can be transferred to the evaluation and the development of other processes.

Content

Introduction to liquid chemical fuels: sources, resources/reserves, consumption, characteristic properties of raw materials and products, overview of conversion processes.

Petroleum and petroleum refining: characterization of petroleum crude oils and refinery products, physical separation processes, chemical conversion/upgrading processes (chemical equilibrium, reaction technology etc.), refinery structures.

Non-conventional liquid fuels e. g. from synthesis processes or biomass feedstocks (vegetable oil and derived fuels, alcohols, synthetic liquid fuels).

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

Literature

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

M**5.131 Module: Refrigeration B - Foundations of Industrial Gas Processing [M-CIWVT-104354]**

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

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

Mandatory			
T-CIWVT-108914	Refrigeration B - Foundations of Industrial Gas Processing	6 CR	Grohmann

Competence Certificate

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

Prerequisites

None

Competence Goal

Understanding the principles of different processes for gas liquefaction and gas separation; Analysing processes in order to reveal the sources of energy demand; Applying the principles of thermodynamics of mixtures and analysing the states of fluids in rectification columns; Assessing the potential of technical concepts from a thermodynamic point of view

Content

Gas liquefaction processes, process analyses, refrigerators and mixed-refrigerant cycles, gas separation by low-temperature rectification, air separation and extraction of noble gases, processing and separation of natural gas, ethylene production, processing of H₂-enriched gas mixtures, storage and transport of liquefied gases

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.132 Module: Rheology and Processing of Disperse Systems [M-CIWVT-104336]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

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

Mandatory			
T-CIWVT-108891	Rheology and Processing of Disperse Systems	8 CR	Oelschlaeger, Willenbacher

Competence Certificate

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

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.133 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	Rheology and Processing of Polymers	8 CR	Hochstein, Willenbacher

Competence Certificate

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.134 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](#)
[Specialized Course I / Product Design](#)

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

Mandatory			
T-CIWVT-108881	Rheology and Rheometry	4 CR	Hochstein

Competence Certificate

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

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.135 Module: Rheology of Complex Fluids and Advanced Rheometry [M-CIWVT-104331]**

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Applied Rheology](#)

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

Mandatory			
T-CIWVT-108886	Rheology of Complex Fluids and Advanced Rheometry	4 CR	Oelschlaeger, Willenbacher

Competence Certificate

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

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

The grade of the oral examination is the module grade.

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.136 Module: Rheology of Disperse Systems [M-CIWVT-104391]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#)

Credits
2

Grading scale
Grade to a tenth

Recurrence
Each summer term

Duration
1 term

Language
German

Level
4

Version
1

Mandatory			
T-CIWVT-108963	Rheology of Disperse Systems	2 CR	Willenbacher

Prerequisites

None

Workload

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

M**5.137 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](#)
[Specialized Course I / Product Design](#)

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

Mandatory			
T-CIWVT-108884	Rheology of Polymers	4 CR	Willenbacher

Competence Certificate

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

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.138 Module: Selected Formulation Technologies [M-CIWVT-103064]**

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Advanced Fundamentals \(BIW\)](#)
[Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 10/1/2022)
[Specialized Course I / Product Design](#) (Usage from 10/1/2022)
[Specialized Course I / Bioresource Engineering](#) (Usage from 10/1/2022)

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

Mandatory			
T-CIWVT-106037	Selected Formulation Technologies	6 CR	Karbstein, Leister

Competence Certificate

The examination is a written examination with a duration of 120 minutes.

Prerequisites

None

Competence Goal

Students understand specific needs of liquid and solid formulations for life science application. They are able to select appropriate additives and understand their relevance for product preparation and stabilisation. They understand and master basics of formulation preparation and cope with the design of suitable processes. They are acquainted with conventional and innovative technologies. They identify correlations between process parameters and product performance. They are able to transfer process knowledge between different products.

Students are able to identify relevant parameters for product performance. They are able to select suitable scientific based characterisation methods and can discuss analytic results critically.

Content

Additives and active substances (LV FT1: U. van der Schaaf/LVT):

Substance categories: Properties and molecular structure; Purposes and functionality: Interfacial activity, modulation of viscosity, etc.; Measurement techniques and newest developments.

Emulsification and Dispersion Technologies : (LV FT2: H.P. Karbstein/LVT) Characteristics of liquid formulations; processing objectives; fundamentals of particle desaggregation and disruption as well as droplet break-up; particle and droplet stabilization in liquid continuous phase; apparatus design and operation principle; process design; process and property function for preparation of liquid formulations; characterisation of liquid formulation properties: fundamentals and measurement devices; innovative developments.

Drying of dispersions: (LV FT3: H.P. Karbstein/LVT)

Objectives of drying, fundamentals of product stabilisation for extended shelf life; processes using the examples of spray drying, drum drying, freeze drying: operation principles, apparatus design, process design, process function; fundamentals of powder quality characterization, instant properties, fundamentals and measurement devices; agglomeration for improved instant properties.

Workload

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

Literature

- Köhler, K., Schuchmann, H. P.: Emulgiertechnik, 3. Auflage, Behr's Verlag, Hamburg, 978-3-89947-869-3, 2012.
- McClements, D. J.: Food Emulsions, 3. Auflage, CRC Press, 978-1-49872-668-9, 2015
- Mezger, T.G.: Das Rheologie Handbuch, 4. Auflage, Vincentz Network, 978-3866308633, 2012
- Vorlesungsfolien, Skripte mit Übungsfragen, Übungsfragen im Multiple-Choice-Format (mit Lösungen), Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)

M**5.139 Module: Seminar [M-MATH-103276]****Responsible:** PD Dr. Stefan Kühnlein**Organisation:** KIT Department of Mathematics**Part of:** [Technical Supplement Course](#) (Usage from 4/1/2021)
[Specialized Course I / Mechanical Process Engineering](#) (Usage from 4/1/2021)**Credits**
3**Grading scale**
pass/fail**Recurrence**
Each term**Duration**
1 term**Language**
German**Level**
5**Version**
1

Mandatory			
T-MATH-106541	Seminar Mathematics	3 CR	

Competence Certificate

The control of success (pass/fail) is based on a seminar talk lasting at least 45 minutes.

Prerequisites

none

Competence Goal

At the end of the module the participants should

- have analyzed a specific problem in a mathematical area
- be able to discuss subject-specific problems in the given context and present as well as defend them, using suitable media
- have summarized the most relevant results of their topic
- have communicative, organizational and didactic skills in complex problem analyses at their disposal. They can use techniques of scientific work.

Content

The specific content is based on the seminar topics being offered.

Module grade calculation

omitted as ungraded (pass/fail)

Workload

Total work load: 90 hours

Attendance: 30 hours

Self studies: 60 hours

- Preparation of the scientific content of the talk
- Preparation of a didactical concept for the talk
- Preparation of the presentation (blackboard, beamer, etc.)
- getting practice for the talk, creating a hand-out

M**5.140 Module: Seminar of Food Processing in Practice [M-CIWVT-105932]**

Responsible: Dr.-Ing. Ulrike van der Schaaf
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage from 4/1/2022)
[Specialized Course I / Food Process Engineering](#) (Usage from 4/1/2022)

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

Mandatory			
T-CIWVT-109129	Seminar of Food Processing in Practice with Excursion	2 CR	van der Schaaf

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

5.141 Module: Single-Cell Technologies [M-CIWVT-106564]**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** **Technical Supplement Course** (Usage from 10/1/2023)

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

Mandatory			
T-CIWVT-113231	Single-Cell Technologies	4 CR	Grünberger

Competence Certificate

The learning control is an oral examination lasting approx. 30 minutes.

Prerequisites

None

Competence Goal

Upon completion of the course, the students are able to:

- Know the fields and interdisciplinary nature of single-cell technologies
- Know basic methods in the field of single-cell technologies
- Are able to evaluate single-cell technologies
- Are able to choose single-cell platforms for specific biological questions
- Are aware of the complexity of the development of single-cell technologies

Content

While cell populations have historically been viewed as homogeneously behaving individuals, new research shows that cell-to-cell heterogeneity exists in all scales of biological systems. While most measurements are based on averages, individual cells can show dramatic differences in their properties such as growth, division and metabolic activity. Single-cell technologies have revolutionized our ability to delve into the intricacies of biological systems. By allowing the analysis of individual cells, these cutting-edge techniques provide insights into cellular heterogeneity, rare cell populations, and dynamic processes. Single-cell technologies range from single-cell microscopy, single-cell omics to single-cell cultivation, which all can be used to uncover hidden layers of complexity of a variety of cell types. These technologies have emerged in the last years and show a transformative, maybe revolutionizing, potential in many fields of basic and applied research of various scientific disciplines. This ranges from microbiology, biomedical research, drug discovery, biotechnology and bioprocess engineering.

The "Single-cell technologies" lecture aims to give an introduction and overview into single-cell technologies and provide students with a comprehensive understanding of the fundamental principles and practical applications of single-cell research. After a short introduction into the field, students will explore various single-cell technologies. Focus will be given on emerging field of microfluidic single-cell cultivation methods and their application. The characteristic features and functionality of selected systems are explained using current examples from science and research. Possibilities for applications in biotechnology and microbiology are discussed. The last part of the lecture provides an insight into single-cell data analysis and future challenges within the field. The course emphasizes the importance of uncovering cellular heterogeneity, and students will discover the role of these technologies in microbiology and biotechnology. They will stay updated on emerging trends and emerging application of this technically complex, but fast developing field. The interdisciplinary nature of single-cell technologies will be emphasized, fostering effective collaboration across fields. State of the art knowledge will be supported by insights into emerging fields and topics within the field. Upon completion, students will be well-prepared to contribute to cutting-edge research and innovations of single-cell technologies. The interdisciplinary and application-oriented lecture is aimed at technically interested students of molecular biotechnology, microbiology, biochemistry, bioprocess engineering, chemical engineering as well as all interested students of life sciences, chemistry, and physics.

Module grade calculation

The module grade is the grade of the oral exam.

Workload

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

Literature

No specific textbook is recommended.

M**5.142 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 / Product Design](#)
[Specialized Course I / Technical Thermodynamics](#)

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

Mandatory			
T-CIWVT-108822	Sol-Gel Processes	4 CR	Müller

Competence Certificate

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

Prerequisites

None

Competence Goal

Students are capable to describe and analyse the complete process from the starting material (sol) to the finished product (gel), like ceramics.

They are qualified to evaluate and estimate every single step of the entire process critically.

Content

Production of functional material via the sol-gel-process: hydrolyse and condensation, the gel-building process (gelation) and aging, deformation and rheology, drying-process, structure of aero- and xerogels, surface-chemistry and modification of the surface and finally sintering. Applications: powder, ceramics, glass, membranes and coatings.

Workload

- Attendance time (Lecture): 22,5 h
- Homework: 16 h
- Exam Preparation: 80 h

M**5.143 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 / Product Design](#)
[Specialized Course I / Technical Thermodynamics](#)

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

Mandatory			
T-CIWVT-108822	Sol-Gel Processes	4 CR	Müller
T-CIWVT-108823	Practical Course Sol-Gel Processes	2 CR	Müller

Competence Certificate

The examination consists of:

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

The grade of the oral examination is the module grade.

Prerequisites

None

Competence Goal

Students are capable to describe and analyse the complete process from the starting material (sol) to the finished product (gel), like ceramics.

They are qualified to evaluate and estimate every single step of the entire process critically.

Content

Production of functional material via the sol-gel-process: hydrolyse and condensation, the gel-building process (gelation) and aging, deformation and rheology, drying-process, structure of aero- and xerogels, surface-chemistry and modification of the surface and finally sintering. Applications: powder, ceramics, glass, membranes and coatings.

Workload

- Attendance time (Lecture): 22,5 h
- Internship: 11,5 h, 4 attempts
- Homework: 16 h
- Exam Preparation: 130 h

M

5.144 Module: Solid Liquid Separation [M-CIWVT-104342]**Responsible:** Dr.-Ing. Marco Gleiß**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Mechanical Process Engineering](#)
[Specialized Course I / Bioresource Engineering](#)

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

Mandatory			
T-CIWVT-108897	Solid Liquid Separation	8 CR	Gleiß

Competence Certificate

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

Prerequisites

None

Competence Goal

The students are able to apply the fundamental laws and the derived physical principles of the particle separation from liquids and not only to relate them to the principally suited separation apparatuses but also special variants. They have the ability to apply the relationship between product operation and design parameters to different separation techniques. They can analyse separation problems with scientific methods and give alternative problem solution proposals.

Content

physical fundamentals, apparatuses, applications, strategies; characterisation of particle systems and slurries; pretreatment methods to enhance the separability of slurries; fundamentals, apparatuses and process technology of static and centrifugal sedimentation, flotation, depth filtration, crossflow filtration, cake forming vacuum and gas overpressure filtration, filter centrifuges and press filters; filter media; selection criteria and scale-up methods for separation apparatuses and machines; apparatus combinations; case studies to solve separation problems

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 60 h
- Homework: 80 h
- Exam Preparation: 100 h

Literature

Anlauf: Skriptum "Mechanische Separationstechnik - Fest/Flüssig-Trennung"

M**5.145 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 / Product Design](#)
[Specialized Course I / Entrepreneurship in Process Engineering](#)

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

Mandatory			
T-CIWVT-108885	Stability of Disperse Systems	4 CR	Willenbacher

Competence Certificate

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

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

Prerequisites

None

Module grade calculation

The grade of the oral examination is the module grade.

Workload

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

M**5.146 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	Statistical Thermodynamics	6 CR	Enders

Competence Certificate

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

Prerequisites

Thermodynamics III

Modeled Conditions

The following conditions have to be fulfilled:

1. The module [M-CIWVT-103058 - Thermodynamics III](#) must have been passed.

Competence Goal

The students are able to understand the basics of statistical mechanics and they are able to recognize the advantage and disadvantage for application in chemical engineering.

Content

Boltzmann-method, Gibbs-method, real gases, equations of state, polymers

Module grade calculation

The module grade is the grade of the oral exam.

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**5.147 Module: Structure and Reaction of Aquatic Humic Substances [M-CIWVT-104302]****Responsible:** Dr. Gudrun Abbt-Braun**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Water Technology](#) (Usage until 9/30/2024)**Credits**
2**Grading scale**
Grade to a tenth**Recurrence**
Each summer term**Duration**
1 term**Language**
German**Level**
4**Version**
1

Mandatory			
T-CIWVT-108842	Structure and Reaction of Aquatic Humic Substances	2 CR	Abbt-Braun

Competence Certificate

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

Prerequisites

None

Competence Goal

Students can describe the distribution and the behaviour and the interaction of humic substances in aquatic systems and during water treatment processes. They can explain their major structural functions.

They are familiar with the basic methods to characterize humic substances. They are able to select appropriate methods for the analysis and the determination of humic substances in aquatic systems and to evaluate the results.

Content

Origin, definitions, structure, isolation methods, characterization of humic substances, interaction with other water constituents, behaviour during water treatment processes.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 15 h
- Homework: 25 h
- Exam Preparation: 20 h

Literature

- Thurman, E. M. (1985): Organic Geochemistry of Natural Waters. Martinus Nijhoff / Dr. W. Junk Publishers, Dordrecht.
- Frimmel, F. H., Abbt-Braun, G. et al. (Hrsg.) (2002): Refractory Organic Substances in the Environment. Wiley-VCH, Weinheim.
- Vorlesungsunterlagen im ILIAS

M**5.148 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	3

Election notes

Within the scope of the specialization Entrepreneurship in Process Engineering, the choice of an innovation project is always linked to the choice of a specific elective module:

Option 1

- Innovation Project Porous Ceramics from the 3D Printer **OR**
- Innovation Project Electronic Devices from Printable Conductive Materials
- Module: Innovative Concepts for Formulation and Processing of Printable Materials **OR**
- Module: Stability of Disperse Systems

Option 2

- Innovative Food Design by Extrusion Technology
- Module: Extrusion Technology in Food Processing

Option 3

- Fully Renewable Fuel with Minimal Emission Levels for Marine Engines
- Module: Liquid Transportation Fuels

Mandatory			
T-WIWI-102864	Entrepreneurship	3 CR	Terzidis
T-WIWI-110166	SIL Entrepreneurship Project	3 CR	Terzidis
Innovation Project (Election: 6 credits)			
T-CIWVT-112201	Innovation Project Porous Ceramics from the 3D Printer	6 CR	Willenbacher
T-CIWVT-112202	Innovative Food Design by Extrusion Technology	6 CR	Emin
T-CIWVT-112256	Fully Renewable Fuel with Minimal Emission Levels for Marine Engines	6 CR	Sauer
T-CIWVT-113226	Innovation Project Electronic Devices from Printable Conductive Materials	6 CR	Willenbacher

Competence Certificate

The learning control consists of three partial achievements:

- written examination on the lecture entrepreneurship lasting 60 minutes
- examination of another type: SIL entrepreneurship project: Term paper and presentation
- examination of another type: Innovation project

Prerequisites

None.

Competence Goal

The students will be introduced to the field of entrepreneurship. After successful attendance of the course, they should have an overview of the sub-areas of entrepreneurship and be able to understand basic concepts of entrepreneurship.

On the basis of known engineering knowledge, students are able to independently develop technical prototypes for the market launch of an innovation. They are capable to develop a project plan from idea to implementation. They transfer process engineering knowledge to user-convincing product innovations. Students can analyze and evaluate important economic aspects. They are able to create concepts for the procurement of raw materials and the scaling of product manufacturing to the relevant industrial scale. They know how to develop market and cost analyses as well as marketing and sales strategies. Students are able to present their product clearly and convincingly to potential customers in the form of a pitch deck.

Content

Lecture Entrepreneurship

The lecture Entrepreneurship introduces the basic concepts of entrepreneurship. The individual stages of dynamic business development are covered. Emphasis is placed on the introduction to methods for generating innovative business ideas, translating patents into business concepts, and general principles of business planning. Further contents are the conception and use of service-oriented information systems for founders, technology management and business model generation as well as lean startup methods for the implementation of business ideas by way of controlled experiments in the market.

Students Innovation Lab: One of several projects can be selected:

- **Innovation project Porous ceramics from the 3D printer**

Porous ceramics can be used in a variety of ways, for example as:

- Hot gas filters for industrial processes
- Drinking water filters for the removal of contaminants such as heavy metals or viruses
- Catalyst supports for the degradation of pollutants, environmental remediation or hydrogen production
- Lightweight materials with high specific strength and temperature resistance
- Biomimetic materials, e.g. as bone substitutes

In this innovation project you will develop a prototype consisting of an innovative porous ceramic and document its technical feasibility. You will develop a concept for industrial-scale production and plan marketing. For this purpose, you will conduct a market analysis and develop a business model including price calculation, cost and financial planning as well as marketing and sales strategy.

- **Innovation Project Electronic Devices from Printable Conductive Materials**

Printable, conductive materials can be turned into electronic devices in a variety of ways, for example:

- by means of screen printing processes:
 - Mass production of electrical circuits
 - Contacting of solar cells
- via 3D printing:
 - Applications in the Smart and IoT sectors
 - Rapid Prototyping
 - Integration of complex electrical structures in the component without additional process steps
- In this innovation project, you will develop a prototype of an electrical device that is produced with the help of a printable, conductive material and document its technical feasibility. You will develop a concept for industrial-scale production and plan marketing. For this purpose, you will conduct a market analysis and develop a business model including price calculation, cost and financial planning as well as marketing and sales strategy.

- **Innovative Food Design by Extrusion Technology**

Extrusion is currently one of the key technologies for the production of sustainable foods, e.g. plant-based meat, fish or cheese alternatives or upcycled cereals or snacks. In this project, our team will develop a new product in this area, from concept to market. To do this, we will first analyze the relevant products on the market in terms of their core characteristics, such as sustainability, sensory, cost, composition and innovative character. We will also discuss current trends, consumer needs and marketing strategies in this segment. Based on the results, we will design a new product considering the principles of product design and implement it using extrusion technology. The product and the overall concept (incl. marketing, cost analyses) will be presented in the form of a start-up pitch.

- **Fully Renewable Fuel with Minimal Emission Levels for Marine Engines**

A blend scenario for a 100 % renewable fuel with minimal emission values for ship engines will be investigated. In this blend scenario, two renewable fuels will be investigated: Oxymethylene Ethers (OMEn) and Hydrogenated Vegetable Oils (HVO). OMEn, with the general formula $\text{CH}_3(-\text{OCH}_2-\text{nO}-\text{CH}_3)$, are a novel class of chemical compounds that exhibit diesel-like properties and are characterized by soot-free combustion. HVO is a paraffinic fuel and, in contrast to fossil diesel, is practically free of aromatics and during combustion there is a significant reduction in pollutant emissions.

The objectives of this project work are as follows:

- Investigate the market potential of OME/HVO blends in different ratios for combustion in ship engines.
- Production of an OME mixture, as well as the production of OME/HVO blends.
- Put a simple laboratory apparatus into operation to compare the combustion characteristics of the produced OME/HVO blends with conventional diesel.

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**5.149 Module: Supplementary Studies on Culture and Society [M-ZAK-106235]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: **Additional Examinations** (Usage between 4/1/2023 and 4/1/2023)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
22	Grade to a tenth	Each term	3 terms	German	3	1

Election notes

With the exception of the final oral exam and the practice module, students have to self-record the achievements obtained in the Supplementary Studies on Culture and Society in their study plan. 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 ZAK homepage at <https://www.zak.kit.edu/begleitstudium-bak.php>. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements **both for your interdisciplinary qualifications and for the supplementary studies**, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the in-depth module, achievements have to be obtained in three different areas. The areas are as follows:

- Technology & Responsibility
- Doing Culture
- Media & Aesthetics
- Spheres of Life
- Global Cultures

You have to obtain two achievements with 3 credits each and one achievement with 5 credits. To self-record achievements in the in-depth module, you first have to elect the matching partial achievement.

Note: If you registered for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §20 (2) of the regulations for the Supplementary Studies on Culture and Society. Your overall grade for the supplementary studies will thus be calculated as the average of the examination grades, not as the average of the module grades.

Mandatory			
T-ZAK-112653	Basics Module - Self Assignment BAK	3 CR	Mielke, Myglas
In-depth Module (Election: 3 items)			
T-ZAK-112654	In-depth Module - Technology & Responsibility - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112655	In-depth Module - Doing Culture - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112656	In-depth Module - Media & Aesthetics - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112657	In-depth Module - Spheres of Life - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112658	In-depth Module - Global Cultures - Self Assignment BAK	3 CR	Mielke, Myglas
Mandatory			
T-ZAK-112660	Practice Module	4 CR	Mielke, Myglas
T-ZAK-112659	Oral Exam - Supplementary Studies on Culture and Society	4 CR	Mielke, Myglas

Competence Certificate

The monitoring is explained in the respective partial achievement.

They are composed of:

- minutes
- presentations
- a seminar paper
- an internship report
- an oral examination

After successful completion of the supplementary studies, the graduates receive a graded certificate and a KIT certificate.

Prerequisites

The offer is study-accompanying and does not have to be completed within a defined period of time. Enrolment or acceptance for graduation must be present when registering for the final examination.

KIT students register for the supplementary studies by selecting this module in the student portal and self-checking a performance. In addition, registration for the individual courses is necessary, which is possible shortly before the beginning of each semester.

The course catalogue, statutes (study regulations), registration form for the oral exam, and guides for preparing the various written performance requirements can be found as downloads on the ZAK homepage at www.zak.kit.edu/begleitstudium-bak.

Competence Goal

Graduates of the Supplementary Studies on Culture and Society demonstrate a sound basic knowledge of conditions, procedures and concepts for analysing and shaping fundamental social development tasks in connection with cultural topics. They have gained a well-founded theoretical and practical insight into various cultural studies and interdisciplinary topics in the field of tension between culture, technology and society in the sense of an expanded concept of culture.

They are able to place the contents selected from the specialization module in the basic context as well as to analyse and evaluate the contents of the selected courses independently and exemplarily and to communicate about them scientifically in written and oral form. Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective.

Content

The Supplementary Studies on Culture and Society can be started from the 1st semester and is not limited in time. It comprises at least 3 semesters. The supplementary studies are divided into 3 modules (basics, in-depth studies, practice). A total of 22 credit points (ECTS) are earned.

The thematic elective areas of the supplementary studies are divided into the following 5 modules and their sub-topics:

Block 1 Technology & Responsibility

Value change / ethics of responsibility, technology development / history of technology, general ecology, sustainability

Block 2 Doing Culture

Cultural studies, cultural management, creative industries, cultural institutions, cultural policy

Block 3 Media & Aesthetics

Media communication, cultural aesthetics

Block 4 Spheres of Life

Cultural sociology, cultural heritage, architecture and urban planning, industrial science

Block 5 Global Cultures

Multiculturalism / interculturalism / transculturalism, science and culture

Module grade calculation

The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

In-depth Module

- presentation 1 (3 ECTS)
- presentation 2 (3 ECTS)
- seminar paper incl. presentation (5 ECTS)
- oral examination (4 ECTS)

Annotation

With the Supplementary Studies on Culture and Society, KIT provides a multidisciplinary study offer as an additional qualification, with which the respective specialized study program is supplemented by interdisciplinary basic knowledge and interdisciplinary orientation knowledge in the field of cultural studies, which is becoming increasingly important for all professions.

Within the framework of the supplementary studies, students acquire in-depth knowledge of various cultural studies and interdisciplinary subject areas in the field of tension between culture, technology and society. In addition to high culture in the classical sense, other cultural practices, common values and norms as well as historical perspectives of cultural developments and influences are considered.

In the courses, conditions, procedures and concepts for the analysis and design of fundamental social development tasks are acquired on the basis of an expanded concept of culture. This includes everything created by humans - also opinions, ideas, religious or other beliefs. The aim is to develop a modern concept of cultural diversity. This includes the cultural dimension of education, science and communication as well as the preservation of cultural heritage. (UNESCO, 1982)

According to § 16 of the statutes, a reference and a certificate are issued by the ZAK for the supplementary studies. The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).

Workload

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

- basic module approx. 90 h
- in-depth module approx. 340 h
- practical module approx. 120 h

total: approx. 550 h

Learning type

- lectures
- seminars
- workshops
- practical course

Literature

Recommended reading of primary and specialized literature will be determined individually by each instructor.

M**5.150 Module: Supplementary Studies on Sustainable Development [M-ZAK-106099]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: **Additional Examinations** (Usage between 4/1/2023 and 4/1/2023)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
19	Grade to a tenth	Each term	3 terms	German	3	1

Election notes

With the exception of the final oral exam, students have to self-record the achievements obtained in the Supplementary Studies on Sustainable Development in their study plan. 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 ZAK homepage at <https://www.zak.kit.edu/begleitstudium-bene>. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements **both for your interdisciplinary qualifications and for the supplementary studies**, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the elective module, you need to obtain 6 credits worth of achievements in two of the four areas:

- Sustainable Cities & Neighbourhoods
- Sustainable Assessment of Technology
- Subject, Body, Individual: The Other Side of Sustainability
- Sustainability in Culture, Economy & Society

Usually, two achievements with 3 credits each have to be obtained. To self-record achievements in the elective module, you first have to elect the matching partial achievement.

Note: If you registered for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §19 (2) of the regulations for the Supplementary Studies on Sustainable Development. Your overall grade for the supplementary studies will thus be calculated as the average of the examination grades, not as the average of the module grades.

Mandatory			
T-ZAK-112345	Basics Module - Self Assignment BeNe	3 CR	Myglas
Elective Module (Election: at least 6 credits)			
T-ZAK-112347	Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe	3 CR	
T-ZAK-112348	Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe	3 CR	
T-ZAK-112349	Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe	3 CR	
T-ZAK-112350	Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe	3 CR	
Mandatory			
T-ZAK-112346	Specialisation Module - Self Assignment BeNe	6 CR	Myglas
T-ZAK-112351	Oral Exam - Supplementary Studies on Sustainable Development	4 CR	

Competence Certificate

The monitoring is explained in the respective partial achievement .

They are composed of:

- protocols
- a reflection report
- presentations
- presentations
- the elaboration of a project work
- an individual term paper

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

Prerequisites

The course is offered during the course of study and does not have to be completed within a defined period of time. Enrolment is required for all performance assessments of the modules of 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 self-booking a performance. Registration for courses, performance assessments and examinations is regulated by § 6 of the Statutes and is usually possible shortly before the beginning of the semester.

The course catalogue, statutes (study regulations), registration form for the oral exam and guidelines for preparing the various written performance requirements can be found as downloads on the ZAK homepage at <http://www.zak.kit.edu/begleitstudium-bene>.

Competence Goal

Graduates of the supplementary studies in sustainable development acquire additional practical and professional competencies. Thus, the supplementary study program enables the acquisition of basics and initial experience in project management, trains teamwork skills, presentation skills and self-reflection, and also creates a fundamental understanding of sustainability that is relevant for all professional fields.

Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective. They are able to place the contents selected from the modules "Elective" and "Advanced" in the basic context as well as to independently and exemplarily analyse and evaluate the contents of the selected courses and to scientifically communicate about them in written and oral form.

Content

The supplementary study program Sustainable Development can be started from the 1st semester and is not limited in time. The wide range of courses offered by ZAK makes it possible to complete the program usually within three semesters. The supplementary studies comprise 19 credit points (LP). It consists of three modules: Basic Module, Elective Module and Advanced Module.

The thematic elective areas of the supplementary studies are divided into the following 4 modules and their subtopics in Module 2 (elective module):

Block 1 Sustainable Cities and Neighbourhoods

The courses provide an overview of the interaction of social, ecological, and economic dynamics in the microcosm of the city.

Block 2 Sustainability Assessment of Technology

Mostly based on ongoing research activities, methods and approaches of technology assessment are elaborated.

Block 3 Subject, Body, Individual: The other Side of Sustainability

Different approaches are presented to the individual perception, experience, shaping and responsibility of relationships to the environment and to oneself.

Block 4 Sustainability in Culture, Economy & Society

Courses usually have an interdisciplinary approach, but may also focus on one of the areas of culture, economics or society, both in application and in theory.

The core of the supplementary studies is a case study in the specialization area. In this project seminar, students conduct sustainability research with practical relevance themselves. The case study is supplemented by an oral examination with two topics from module 2 (elective module) and module 3 (in-depth module).

Module grade calculation

The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

Elective module

- Presentation 1 (3 ECTS)
- Presentation 2 (3 ECTS)

Advanced module

- individual term paper (6 ECTS)
- oral examination (4 ECTS)

Annotation

The Supplementary Studies on Sustainable Development at KIT is based on the conviction that a long-term socially and ecologically compatible coexistence in the global world is only possible if knowledge about necessary changes in science, economy and society is acquired and applied.

The interdisciplinary and transdisciplinary Studies on Sustainable Development enables diverse access to transformation knowledge as well as basic principles and application areas of sustainable development. According to the statutes § 16, a certificate is issued by the ZAK for the complementary studies.

The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).

In the specialised studies, modules and partial achievements can be recognised within the framework of the additional achievements or e.g. the interdisciplinary qualifications. This must be regulated via the respective subject study programme.

The focus is on experience- and application-oriented knowledge and competences, but theories and methods are also learned. The aim is to be able to represent one's own actions as a student, researcher and later decision-maker as well as an individual and part of society under the aspect of sustainability.

Sustainability is understood as a guiding principle to which economic, scientific, social and individual actions should be oriented. According to this, the long-term and socially just use of natural resources and the material environment for a positive development of global society can only be addressed by means of integrative concepts. Therefore, "education for sustainable development" in the sense of the United Nations programme plays just as central a role as the goal of promoting "cultures of sustainability". For this purpose, practice-centred and research-based learning of sustainability is made possible and the broad concept of culture established at ZAK is used, which understands culture as habitual behaviour, lifestyle and changing context for social actions.

The supplementary study programme conveys the basics of project management, trains teamwork skills, presentation skills and self-reflection. Complementary to the specialised studies at KIT, it creates a fundamental understanding of sustainability, which is important for all professional fields. Integrative concepts and methods are essential: in order to use natural resources in the long term and to shape the global future in a socially just way, not only different disciplines, but also citizens, practitioners and institutions must work together.

Workload

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

- Basic module approx. 180 h
- Elective module approx. 150 h
- Consolidation module approx. 180 h

Total: approx. 510 h

Learning type

- lectures
- seminars
- workshops

Literature

Recommended reading of primary and specialist literature is determined individually by the respective lecturer.

M**5.151 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	Surface Effects in Process Engineering	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

5.152 Module: Thermal Separation Processes II [M-CIWVT-104365]**Responsible:** Prof. Dr.-Ing. Matthias Kind**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Thermal Process Engineering](#) (Usage until 9/30/2024)
[Specialized Course I / Technical Thermodynamics](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108926	Thermal Separation Processes II	6 CR	Kind

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

Acquisition of deep understanding of chemical engineering processes using the example of continuous distillation of multi-component mixtures. Ability to transfer this understanding into a numerical model and solving this model. Understanding of column fluid dynamics.

Content

Fundamentals of modelling and simulation of chemical engineering processes using the example of distillation of multi-component mixtures: phase equilibrium, fugacity coefficient, models for activity coefficient, flash, MESH-equations for continuous distillation, solution method of Thiele and Gaddes, introduction to advanced numerical methods, fundamentals of fluid dynamic design considerations of tray and packed columns (python, excel or other programming language).

Workload

- Attendance time (Lecture): 45 h
- Homework: 70 h
- Exam Preparation: 70 h

Literature

- Gmehling, J.; Kolbe, B.; Kleiber, M.; Rarey, J. R. Chemical thermodynamics; Wiley-VCH, 2012
- Schlönder, E.-U.; Thurner, F. Distillation, Absorption, Extraktion; Lehrbuch Chemie + Technik; Vieweg, 1995
- Stephan, P.; Mayinger, F.; Schaber, K.; Stephan, K. Thermodynamik. Band 2, 15th ed.; Springer, 2010
- VDI-GVC, Ed. VDI-Wärmeatlas, 11., bearb. und erw. Aufl.; VDI-Buch; Springer Vieweg: Berlin, 2013

M**5.153 Module: Thermal Transport Processes [M-CIWVT-104377]**

Responsible: Prof. Dr.-Ing. Matthias Kind
 Prof. Dr.-Ing. Wilhelm Schabel
 Prof. Dr.-Ing. Thomas Wetzel

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-106034	Thermal Transport Processes	6 CR	Kind, Schabel, Wetzel

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.

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**5.154 Module: Thermodynamics III [M-CIWVT-103058]**

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

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

Mandatory			
T-CIWVT-106033	Thermodynamics III	6 CR	Enders

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

Competence Goal

Students are familiar with the basic principles for the description of complex, multicomponent mixtures and thermodynamic equilibria including equilibria with chemical reactions. They are able to select suitable models and to calculate the properties of multicomponent real systems.

Content

Phase- and reaction equilibria of real systems, equations of state for real mixtures, models for activity coefficients, polymer solutions, protein solutions, electrolyte solutions.

Module grade calculation

The module grade is the grade of the written exam.

Workload

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

Literature

1. Stephan, P., Schaber, K., Stephan, K., Mayinger, F.: Thermodynamik, Band 2, 15. Auflage, Springer Verlag, 2010.
2. Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2008.
3. Gmehling, J., Kolbe, B., Kleiber, M., Rarey, J.: Chemical Thermodynamics for Process Simulations, Wiley-VCH Verlag, 2012

M**5.155 Module: Thermodynamics of Interfaces [M-CIWVT-103063]**

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

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

Mandatory			
T-CIWVT-106100	Thermodynamics of Interfaces	4 CR	Enders

Competence Certificate

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

Prerequisites

None

Competence Goal

The students to be familiar with the peculiarities on fluid-fluid and fluid-solid interfacial properties. They are able to calculate interfacial properties (interfacial tension, density - and concentration profiles, adsorption isotherms) using macroscopic and local-dependent methods.

Content

Gibbs-method, density functional theory, experimental methods for characterization of interfaces, adsorption

Module grade calculation

The module grade is the grade of the oral exam.

M**5.156 Module: Unit Operations and Process Chains for Food of Animal Origin [M-CIWVT-104421]****Responsible:** Prof. Dr.-Ing. Heike Karbstein**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Food Process Engineering](#) (Usage until 9/30/2024)
[Specialized Course I / Product Design](#)
[Specialized Course I / Bioresource Engineering](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108996	Unit Operations and Process Chains for Food of Animal Origin	5 CR	Karbstein

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 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 or expected product quality.

Content

Lecture: Milk and dairy products, meat and meat products, sausages, functional foods: Process chains and unit operations

Basics of process design, process energy and raw material related specifics, innovative processes; relevant parameters for keeping food safety and quality.

Module grade calculation

Grade of the module is the grade of oral examination.

Workload

Lectures: 30 h

Homework: 60 h

Exam preparation: 60 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**5.157 Module: Unit Operations and Process Chains for Food of Plant Origin [M-CIWVT-104420]**

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Food Process Engineering](#) (Usage until 9/30/2024)
[Specialized Course I / Product Design](#)
[Specialized Course I / Bioresource Engineering](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108995	Unit Operations and Process Chains for Food of Plant Origin	7 CR	Karbstein

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 or expected product quality.

Content

Food oils and fats, margarines and spreadable fats, cereals, fruits and vegetables, sugar, chocolate, coffee, beer, wine, spirits: Process chains and unit operations: Basics of process design, process energy and raw material related specifics, innovative processes; relevant parameters for keeping food safety and quality.

Workload

- Attendance time (Lecture): 40 h
- Homework: 90 h
- Exam Preparation: 80 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**5.158 Module: Vacuum Technology [M-CIWVT-104478]**

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

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

Mandatory			
T-CIWVT-109154	Vacuum Technology	6 CR	Day

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**5.159 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	Wastewater Treatment Technologies	6 CR	Azari Najaf Abad, Fuchs

Competence Certificate

- 'Teilleistung' T-BGU-109948 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Prerequisites

none

Competence Goal

Students acquire knowledge about typical techniques and facilities in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs. Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content

Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany and abroad. They analyze, evaluate the applied technologies and take decisions when new and more holistic oriented methods can be implemented. Different mechanical, biological and chemical treatment technologies are considered, whereby the treatment of waste water from households and industry as well as the treatment of rainwater is discussed. The visit of at least one municipal wastewater treatment plant in Germany completes the course. The course includes lab work in groups to learn about basic measuring and analytical procedures in wastewater treatment plants.

Module grade calculation

grade of the module is grade of the exam

Annotation

The number of participants in the course is limited to 30 persons. The registration is to be made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 180 h

Recommendation

module 'Urban Water Infrastructure and Management'

Literature

ATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, Berlin

ATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn , Berlin

ATV-DVWK A 131 (2006): Bemessung von einstufigen Belebungsanlagen. Hennef, 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**5.160 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	Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation	5 CR	

Competence Certificate

The Learning control is an examination of another type:

Research proposal of 10 pages and an oral presentation of 10 minutes (individual work). The grade will be a composite of the proposal (submission in week 13 before class) and oral & poster presentation (all day workshop with researcher participation).

Competence Goal

The goal of this course is to get an overview of current challenges in the circular economy focused on the water – energy – environment nexus. Based on individual student interest a topic will be identified and a research plan developed encompassing a thorough background research to establish the state-of-the-art, identification of a specific research problem and research questions suitable to solve this problem. Concepts of novelty and excellence will be explored in an international context. Following the individual topic choice, the research proposal will be developed individually in a tutor group (divided into water, energy, environment) while lectures on required skills will accompany this process. As an outlook beyond this course, criteria to consider when looking for research careers such as applying for funding/scholarships, considering choices in research environment and supervision, performance indicators in research and university rankings will be introduced to enable informed decisions. The proposal will be communicated in writing, as a brief presentation and as a poster, which equips students brilliantly not only for a masters thesis but also a future research publication or a PhD.

Content

In a time of limiting resources, climate change and ever increasing demand for resources the concept of a circular economy is inevitable to create a more sustainable utilization of our key resources, water, energy and 'environment'. Concepts of zero liquid discharge, water reuse, carbon net zero, resource recovery and environmental pollution reduction are all part of this concept where waste is returned to use. The water – energy – environment nexus is the particular focus of this course. Global water issues, water and wastewater treatment, desalination, water reuse, micropollutants, decentralized systems, water & sanitation in international development, renewable energies, environmental pollution, climate change, resource recovery – and many more topics will inspire future research.

Module grade calculation

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

Workload

- Contact time: lectures and tutorials 60 hrs (4 SWS)
- Group and self study: 50 hrs
- Preparation of assessments and participation at the group presentations (one full day): 30 hrs

M**5.161 Module: Water Quality Assessment [M-CIWVT-104301]****Responsible:** Dr. Gudrun Abbt-Braun**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [Technical Supplement Course](#) (Usage until 9/30/2024)
[Specialized Course I / Water Technology](#) (Usage until 9/30/2024)

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

Mandatory			
T-CIWVT-108841	Water Quality Assessment	6 CR	Abbt-Braun

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

Students can explain links between the geogenic and anthropogenic occurrence and the concentration of organic and inorganic compounds in the hydrological cycle. They get knowledge about the analysis of the water constituents and of microorganism in the water samples. They are able to do calculations, and to compare and interpret data. They will learn how to use different methods, and to interpret water quality assessment.

Content

Various types of water, legislation, analytical definitions, 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, liquid chromatography, infrared spectroscopy, gas chromatography), water specific sum parameters (DOC, AOX, AOS, CSB, BSB), microbiology.

Module grade calculation

The grade of the oral examination is the module grade.

Workload

- Attendance time (Lecture): 45 h
- Homework: 65 h
- Exam Preparation: 70 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. 3. Edition, Wiley & Sons, Hoboken.
- Patnaik P. (2017): 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.
- Vorlesungsunterlagen im ILIAS

M**5.162 Module: Water Technology [M-CIWVT-103407]****Responsible:** Prof. Dr. Harald Horn**Organisation:** KIT Department of Chemical and Process Engineering

Part of: [Technical Supplement Course](#)
[Specialized Course I / Food Process Engineering](#)
[Specialized Course I / Water Technology](#)
[Specialized Course I / Environmental Process Engineering](#)

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

Mandatory			
T-CIWVT-106802	Water Technology	6 CR	Horn

Competence Certificate

Oral exam, 30 min

Prerequisites

None

Competence Goal

Students learn fundamental knowledge in water chemistry and how to apply it to processes in aquatic systems in general and in reactors for water treatment. Water treatment will be taught for drinking water and partly waste water. The students are able to apply physical, chemical and biochemical treatment for the respective removal of particulate and dissolved components in water. They are able to use the fundamental design parameters for the different types of unit operations.

Content

Water cycle, different types of raw water (ground and surface water). Water as solvent, carbonate balance, differentiation between microbiological and chemical population. Unit operations: sieving, sedimentation, filtration, flocculation, flotation, ion exchange, aeration, oxidation, disinfection, adsorption). For all unit operations design parameters will be provided. Simple 1D models will be discussed for description of kinetics and retention time in reactors for water treatment.

Workload

Attendance time: 45 h

Preparation/follow-up: 60 h

Examination + exam preparation: 75 h

Literature

Crittenden, J. C. et al. (2012): Water treatment – Principles and design. 3. edition, Wiley & Sons, Hoboken.

Jekel, M., Czekalla, C. (Hrsg.) (2016). DVGW Lehr- und Handbuch der Wasserversorgung. Deutscher Industrieverlag.

Lecture notes will be provided in ILIAS

6 Courses

T

6.1 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	Additive Manufacturing for Process Engineering	2 SWS	Lecture / 	Klahn
Exams					
WT 23/24	7241020	Additive Manufacturing for Process Engineering - Examination			Klahn
ST 2024	7293103	Additive Manufacturing for Process Engineering - Examination			Klahn

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

Competence Certificate

Oral examination with a duration of about 30 minutes.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-110903 - Practical in Additive Manufacturing for Process Engineering](#) must have been passed.

T

6.2 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


Version
1





Events					
ST 2024	2243035	Advanced Methods in Nonlinear Control	2 SWS	Lecture / 	Meurer, Jerono
Exams					
ST 2024	7243035	Advanced Methods in Nonlinear Process Control			Meurer, Jerono

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

T

6.3 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	Clean Air - Laws, Technology and Application	2 SWS	Lecture / 	Dittler
Exams					
WT 23/24	7292993	Air Pollution Control - Laws, Technology and Application			Dittler
ST 2024	7292993	Air Pollution Control - Laws, Technology and Application			Dittler

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

T

6.4 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

Version
1

Events					
ST 2024	2211330	Alternative Protein Technologies	2 SWS	Block / 🗨️	Emin
Exams					
ST 2024	7211330	Alternative Protein Technologies	Emin		

Legend: 🖥️ Online, 🔄 Blended (On-Site/Online), 🗨️ On-Site, ✖ Canceled

Competence Certificate

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

Prerequisites

None

T

6.5 Course: Basics Module - Self Assignment BAK [T-ZAK-112653]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

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

Competence Certificate

The monitoring in this module includes a course credit according to § 5 section 4 in the form of minutes of which two are to be handed in freely chosen topics of the lecture series " Introduction to Applied Studies on Culture and Society ". Length: approx. 6,000 characters each (incl. spaces).

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

Fjordevik, Anneli und Jörg Roche: Angewandte Kulturwissenschaften. Vol. 10. Narr Francke Attempto Verlag, 2019.

Annotation

The Basic Module consists of the lecture "Introduction to Supplementary Studies on Culture and Society", which is offered only in the winter semester. It is therefore recommended that students start their studies in the winter semester and complete them before module 2.

T

6.6 Course: Basics Module - Self Assignment BeNe [T-ZAK-112345]**Responsible:** Christine Myglas**Organisation:****Part of:** [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

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

Competence Certificate

The monitoring in this module includes a course credit according to § 5 section 4:

[Introduction to Sustainable Development](#) in the form of minutes of which two are to be handed in freely chosen topics of the lecture series "Introduction to Sustainable Development". Length: approx. 6,000 characters each (incl. spaces).

or

[Sustainability Spring Days at KIT](#) in the form of a reflection report on all components of the project days "Sustainability Spring Days at KIT". Length approx. 12,000 characters (incl. spaces).

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:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

Kropp, Ariane: Grundlagen der Nachhaltigen Entwicklung: Handlungsmöglichkeiten und Strategien zur Umsetzung. Springer-Verlag, 2018.

Pufé, Iris: Nachhaltigkeit. 3. überarb. Edition, UTB, 2017.

Roorda, Niko, et al.: Grundlagen der nachhaltigen Entwicklung. Springer-Verlag, 2021.

Annotation

Module Basics consists of the lecture "Introduction to Sustainable Development", which is only offered in the summer semester or alternatively of the project days "Sustainability Spring Days at KIT", which is only offered in the winter semester. It is recommended to complete the course before Elective Module and Specialisation Module.



In exceptional cases, Elective Module or Specialisation Module can also be completed simultaneously with Basics Module. However, the prior completion of the advanced modules Elective and Specialisation should be avoided.





T

6.7 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 23/24	2304207	Batteries and Fuel Cells	2 SWS	Lecture / 	Krewer
WT 23/24	2304213	Batteries and Fuel Cells (Exercise to 2304207)	1 SWS	Practice / 	Krewer, Lindner
Exams					
WT 23/24	7300056	Batteries and Fuel Cells			
WT 23/24	7304207	Batteries and Fuel Cells			Krewer
ST 2024	7300006	Batteries and Fuel Cells			Krewer


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





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T

6.8 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	Batterie- und Brennstoffzellensysteme	2 SWS	Lecture / 	Weber
Exams					
WT 23/24	7304214	Batteries and Fuel Cells Systems			Weber
ST 2024	7304214	Batteries and Fuel Cells Systems			Weber

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

T

6.9 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 23/24	2212820	Biobased Plastic	2 SWS	Lecture / 	Kindervater, Schmiedl
Exams					
WT 23/24	7212820-VT-BK	Biobased Plastics	Kindervater		
ST 2024	7212820-VT-BK	Biobased Plastics	Kindervater		

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

Competence Certificate

Vertiefungsfach:

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

Technisches Ergänzungsfach or a large number of students:

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

Prerequisites

None

T

6.10 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	Biofilm Systems	2 SWS	Lecture / 	Hille-Reichel, Wagner
Exams					
WT 23/24	7232617	Biofilm Systems			Horn, Hille-Reichel, Wagner
ST 2024	7232617	Biofilm Systems			Horn, Hille-Reichel, Wagner

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

Competence Certificate

Oral exam, about 20 min.

T


6.11 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 23/24	2141864	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 23/24	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber
ST 2024	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I			Guber

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

Competence Certificate

written exam (75 Min.)

Prerequisites

none

T


6.12 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	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 23/24	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber
ST 2024	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II			Guber

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

Competence Certificate

Written exam (75 Min.)

Prerequisites

none

T


6.13 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	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	2 SWS	Lecture / 	Guber, Ahrens
Exams					
WT 23/24	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber
ST 2024	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III			Guber

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

Competence Certificate

Written exam (75 Min.)



Prerequisites





none

T

6.14 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 23/24	2214010	Biopharmaceutical Purification Processes	3 SWS	Lecture / 	Hubbuch, Franzreb
WT 23/24	2214011	Exercises on Biopharmaceutical Purification Processes (2214010)	1 SWS	Practice / 	Hubbuch, Franzreb
Exams					
WT 23/24	7223011	Biopharmaceutical Purification Processes			Hubbuch
ST 2024	7223011	Biopharmaceutical Purification Processes			Hubbuch

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

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

T

6.15 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	Bioprocess Development	2 SWS	Lecture / 	Grünberger
ST 2024	2213021	Bioprocess Development - Exercises	2 SWS	Practice / 	Grünberger
Exams					
WT 23/24	7222001	Bioprocess Development			Grünberger
ST 2024	7222001	Bioprocess Development			Grünberger

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

T

6.16 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	Team Project "99€ Bioreactor": Development of an Innovative Bioreactor Concept	2 SWS	Project (P / 🧠)	Grünberger, Holtmann
Exams					
ST 2024	7210020	Bioreactor Development			Holtmann, Grünberger

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

Prerequisites

None

T

6.17 Course: Biotechnological Production [T-CIWVT-106030]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104384 - Biotechnological Production](#)



Type
Written examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
2

Events					
WT 23/24	2212020	Biotechnical Production Methods	2 SWS	Lecture / 	Holtmann
WT 23/24	2212021	Biotechnical Production Methods - Exercises	1 SWS	Seminar / 	Holtmann
Exams					
WT 23/24	7212020-V-BS	Biotechnological Production			Holtmann
ST 2024	7212020-V-BS	Biotechnological Production			Holtmann

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

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-108492 - Seminar Biotechnological Production](#) must have been passed.

Recommendation

Knowledge in biochemistry, genetics, cell biology and microbiology is required.

T

6.18 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 23/24	2212210	Biotechnological Use of Renewable Resources	2 SWS	Lecture / 	Syldatk
Exams					
WT 23/24	7212210-VT-BR	Biotechnological Use of Renewable Resources	Syldatk		
ST 2024	7212210-VT-BR	Biotechnology in Bioeconomy	Syldatk		

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

Competence Certificate

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



Prerequisites





None

T

6.19 Course: Catalytic Micro Reactors [T-CIWVT-109087]

Responsible: Prof. Dr.-Ing. Peter Pfeifer**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104451 - Catalytic Micro Reactors](#)
[M-CIWVT-104491 - Catalytic Micro Reactors \(including practical course\)](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

Events					
WT 23/24	2220211	Praktikum zu 2220210 Katalytische Mikroreaktoren	1 SWS	Practical course / 	Pfeifer, Dittmeyer, und Mitarbeiter
ST 2024	2220210	Katalytische Mikroreaktoren	2 SWS	Lecture / 	Pfeifer
ST 2024	2220211	Praktikum zu 2220210 Katalytische Mikroreaktoren	1 SWS	Practical course / 	Pfeifer, und Mitarbeiter
Exams					
WT 23/24	7210211	Catalytic Micro Reactors	Pfeifer		
ST 2024	7210211	Catalytic Micro Reactors	Pfeifer		

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

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


Prerequisites





None

T

6.20 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	Catalytic Processes in Gas Technologies	2 SWS	Lecture / 	Bajohr
Exams					
WT 23/24	7230017	Catalytic Processes in Gas Technologies			Bajohr
ST 2024	7230017	Catalytic Processes in Gas Technologies			Bajohr

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

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

Prerequisites

None

T

6.21 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 23/24	2231420	Chemical Hydrogen Storage	2 SWS	Lecture / 	Wolf, Sauer
Exams					
WT 23/24	7231420	Chemical Hydrogen Storage	Wolf		
ST 2024	7231420	Chemical Hydrogen Storage	Wolf		

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

Competence Certificate

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

Prerequisites

None

T

6.22 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 23/24	2220020	Chemical Process Engineering II	2 SWS	Lecture / 	Wehinger
WT 23/24	2220021	Exercises on 2220020 Chemical Process Engineering II	1 SWS	Practice / 	Wehinger
Exams					
WT 23/24	7210104	Chemical Process Engineering II			Wehinger
ST 2024	7210104	Chemical Process Engineering II			Wehinger

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

Competence Certificate

The examination is an oral examination with a duration of approx. 20 minutes.

Prerequisites

None

T

6.23 Course: Chem-Plant [T-CIWVT-109127]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104461 - Chem-Plant](#)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	1

Exams			
WT 23/24	7200101	Chem-Plant	Enders
ST 2024	7200101	Chem-Plant	Enders

Prerequisites

None

Recommendation

Thermodynamics III, Process Technology

T

6.24 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	Combustion and Environment	2 SWS	Lecture / 	Trimis
Exams					
WT 23/24	7231203	Combustion and Environment	Trimis		
ST 2024	7231203	Combustion and Environment	Trimis		

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

Prerequisites

None

T

6.25 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 23/24	2232010	Fundamentals of Combustion Technology	2 SWS	Lecture / 	Trimis
WT 23/24	2232011	Exercises for 2232010 Fundamentals of Combustion Technology	1 SWS	Practice / 	Trimis, und Mitarbeiter
Exams					
WT 23/24	7231201	Combustion Technology			Trimis
ST 2024	7231201	Combustion Technology			Trimis

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

Prerequisites

None

T

6.26 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	Commercial Biotechnology	2 SWS	Lecture / 	Kindervater, und Mitarbeiter
Exams					
WT 23/24	7212810-VT-KB	Commercial Biotechnology	Kindervater		
ST 2024	7212810-VT-KB	Commercial Biotechnology	Kindervater		

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

Competence Certificate

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

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

Prerequisites

None

T

6.27 Course: Complex Phase Equilibria [T-CIWVT-112883]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106358 - Complex Phase Equilibria](#)

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

Competence Certificate

Learning control is an oral examination, duration about 30 minutes.

Prerequisites

None

T

6.28 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
Written examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each term

Version
1

Events					
WT 23/24	2245020	Computational Fluid Dynamics	2 SWS	Lecture / 	Nirschl, und Mitarbeiter
WT 23/24	2245021	Exercises for 2245020 Computational Fluid Dynamics	1 SWS	Practice / 	Nirschl, und Mitarbeiter
Exams					
WT 23/24	7291020	Computational Fluid Dynamics	Nirschl		
ST 2024	7291932	Computational Fluid Dynamics	Nirschl		

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

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

T

6.29 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	Computational Fluid Dynamics and Simulation Lab	4 SWS	Practical course	Thäter, Krause, Simonis
Exams					
ST 2024	7700108	Computational Fluid Dynamics and Simulation Lab			Thäter

Prerequisites

none

T

6.30 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 23/24	2242250	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids	2 SWS	Lecture / 	Hochstein
Exams					
WT 23/24	7290202	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids			Hochstein
ST 2024	7290202	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids			Hochstein

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

Competence Certificate

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

Prerequisites

None

T**6.31 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	Control of Distributed Parameter Systems	3 SWS	Block / 	Meurer
Exams					
WT 23/24	7250002	Control of Distributed Parameter Systems			Meurer
ST 2024	7243040	Control of Distributed Parameter Systems			Meurer

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

T

6.32 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 23/24	2250140	Cryogenic Engineering	2 SWS	Lecture / 	Grohmann
WT 23/24	2250141	Cryogenic Engineering - Exercises	1 SWS	Practice / 	Grohmann
Exams					
WT 23/24	7250140	Cryogenic Engineering	Grohmann		
ST 2024	7200201	Cryogenic Engineering	Grohmann		

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

Competence Certificate

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

Prerequisites

None

T

6.33 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 winter term

Version
1

Events					
WT 23/24	2245120	Data Analysis and Statistics	2 SWS	Lecture / 	Guthausen
Exams					
WT 23/24	7291120	Data Analysis and Statistics	Guthausen		
ST 2024	7291969	Data Analysis and Statistics	Guthausen		

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

Competence Certificate

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

Prerequisites

None

T

6.34 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 23/24	2243070	Data-Based Modeling and Control	2+1 SWS	Lecture / Practice (/ 🎧)	Meurer
Exams					
WT 23/24	7200009	Data-Based Modeling and Control	Meurer		
ST 2024	7243070	Data-Based Modeling and Control	Meurer		


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





T

6.35 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	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2232310	Design of a Jet Engine Combustion Chamber	2 SWS	/ 	Harth
Exams					
WT 23/24	7200010	Design of a Jet Engine Combustion Chamber			Harth
WT 23/24	7231207	Design of a Jet Engine Combustion Chamber			Harth
ST 2024	7231207	Design of a Gas Turbine Combustor			Zarzalis

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

6.36 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 23/24	2220220	Design of Micro Reactors	4 SWS	Lecture / Practice (/ ●)	Pfeifer
Exams					
WT 23/24	7210210	Design of Micro Reactors	Pfeifer		
ST 2024	7210210	Design of Micro Reactors	Pfeifer		

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

Competence Certificate

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

Prerequisites

None





T

6.37 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	Teamprojekt "Eco TROPHELIA": Entwicklung eines innovativen Lebensmittels	3 SWS	Project (P / )	van der Schaaf, Höhne, Schochat, und Mitarbeiter
Exams					
WT 23/24	7220022	Development of an Innovative Food Product			van der Schaaf
ST 2024	7220022	Development of an Innovative Food Product - presentation			van der Schaaf

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

Competence Certificate

Success control is an examination of another kind: a written elaboration


Prerequisites





None

T**6.38 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	Teamprojekt "Eco TROPHELIA": Entwicklung eines innovativen Lebensmittels	3 SWS	Project (P / 	van der Schaaf, Höhne, Schochat, und Mitarbeiter
Exams					
WT 23/24	7220025	Development of an Innovative Food Product			van der Schaaf
ST 2024	7220025	Development of an Innovative Food Product			van der Schaaf

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

Competence Certificate

Success control is an examination of another kind: Seminar/ Presentation.


Prerequisites





None

T**6.39 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 23/24	2241031	Practical Course Digital Design in Process Engineering	2 SWS	Practical course / 	Klahn, Jayavelu
Exams					
WT 23/24	7293100	Digital Design in Process Engineering - Laboratory			Klahn

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

Competence Certificate

Laboratory, ungraded.

Prerequisites

None.

T

6.40 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 23/24	2241030	Digital Design in Process Engineering	2 SWS	Lecture / 	Klahn
Exams					
WT 23/24	7293101	Digital Design in Process Engineering - Oral Examination			Klahn
ST 2024	7293101	Digital Design in Process Engineering - Oral Examination			Klahn

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

Competence Certificate

Learning control is an oral examination with a duration of about 30 minutes according to SPO section 4, subsection 2 No. 2.

Prerequisites

Participation in the laboratory.

Modeled Conditions





The following conditions have to be fulfilled:

1. The course [T-CIWVT-111582 - Digital Design in Process Engineering - Laboratory](#) must have been passed.

T

6.41 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 23/24	2245220	Digitization in Particle Technology	2 SWS	Lecture / 	Gleiß, und Mitarbeiter
Exams					
WT 23/24	7291922	Digitization in Particle Technology	Gleiß		
ST 2024	7291922	Digitization in particle technology	Gleiß		

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


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





Prerequisites

None

T

6.42 Course: Dimensional Analysis of Fluid Mechanics Problems [T-CIWVT-108882]**Responsible:** Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104327 - Dimensional Analysis of Fluid Mechanics Problems](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

Events					
ST 2024	2242230	Dimensional Analysis of Fluid Mechanics Problems	2 SWS	Lecture / 	Hochstein
Exams					
WT 23/24	7290201	Dimensional Analysis of Fluid Mechanics Problems			Hochstein
ST 2024	7290201	Dimensional Analysis of Fluid Mechanics Problems			Hochstein

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

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

Prerequisites

None

T

6.43 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 winter term

Version
1

Events					
WT 23/24	2260210	Drying Technology	2 SWS	Lecture / 	Schabel
WT 23/24	2260211	Exercises for 2260210 Drying Technology	1 SWS	Practice / 	Schabel, und Mitarbeiter
Exams					
WT 23/24	7280022	Drying Technology			Schabel
ST 2024	7280022	Drying Technology			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

6.44 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	Dynamics of Mechanical and Process Engineering Systems	2 SWS	Lecture / 🗎	Jerono, Meurer
ST 2024	2243121	Dynamics of Mechanical and Process Engineering Systems - Exercises	1 SWS	Practice / 🗎	Jerono

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

Competence Certificate

Learning control is an oral exam lasting approx. 45 minutes.

Prerequisites

The written elaboration is a prerequisite for the oral exam.

T



6.45 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	Dynamics of Mechanical and Process Engineering Systems	2 SWS	Lecture / 	Jerono, Meurer
ST 2024	2243121	Dynamics of Mechanical and Process Engineering Systems - Exercises	1 SWS	Practice / 	Jerono

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

Competence Certificate

Learning control is an examination of another type:

Written elaboration on a task that is handed out in the lecture.

Prerequisites

None

T**6.46 Course: Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe [T-ZAK-112349]****Organisation:****Part of:** [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

The content of the Basics Module is helpful.

T**6.47 Course: Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe [T-ZAK-112348]****Organisation:****Part of:** [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

The content of the Basics Module is helpful.

T**6.48 Course: Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe [T-ZAK-112350]****Organisation:****Part of:** [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

The content of the Basics Module is helpful.

T**6.49 Course: Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe [T-ZAK-112347]****Organisation:** University**Part of:** [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

The content of the Basics Module is helpful.

T

6.50 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
1

Events					
WT 23/24	2212010	Electrobiotechnology	2 SWS	Lecture / 	Holtmann
WT 23/24	2212011	Electrobiotechnology - Exercises	1 SWS	Seminar / 	Holtmann
Exams					
WT 23/24	7212010-VT-EBT	Electrobiotechnology	Holtmann		
ST 2024	7212010-VT-EBT	Electrobiotechnology	Holtmann		

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

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113140 - Electrobiotechnology Seminar](#) must have been passed.

T

6.51 Course: Electrobiotechnology Seminar [T-CIWVT-113140]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106518 - Electrobiotechnology](#)





Type
Completed coursework

Credits
2

Grading scale
pass/fail

Version
1



Events					
WT 23/24	2212010	Electrobiotechnology	2 SWS	Lecture / 	Holtmann
WT 23/24	2212011	Electrobiotechnology - Exercises	1 SWS	Seminar / 	Holtmann
Exams					
WT 23/24	7212011-Ü-EBT	Electrobiotechnology Seminar	Holtmann		





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

T

6.52 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	Electrocatalysis	3 SWS	Lecture / 	Röse
ST 2024	2304301	Exercise to 2304300 Electrocatalysis	1 SWS	Practice / 	Röse
Exams					
ST 2024	7300021	Electrocatalysis			Röse

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

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

T**6.53 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	Electrochemistry	Schuster, Nattland, Passerini
ST 2024	7100101EC_2	Electrochemistry	Schuster, Nattland

Prerequisites

none

T

6.54 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 23/24	2231510	Biomass Based Energy Carriers	2 SWS	Lecture / 	Bajohr
WT 23/24	2231511	Exercises on 2231510 Biomass Based Energy Carriers	1 SWS	Practice / 	Bajohr, und Mitarbeiter
Exams					
WT 23/24	7230016	Energy from Biomass			Bajohr
ST 2024	7230016	Energy from Biomass			Bajohr

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

Competence Certificate

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

Prerequisites

None

T

6.55 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 23/24	2232810	Energy Technology I	2 SWS	Lecture / 	Büchner
Exams					
WT 23/24	7231501	Energy Technology			Büchner
ST 2024	7231501	Energy Technology			Büchner

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

Competence Certificate

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

Prerequisites

None

T

6.56 Course: Entrepreneurship [T-WIWI-102864]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)



Type
Written examination





Credits
3

Grading scale
Grade to a third

Recurrence
Each term

Version
1

Events					
WT 23/24	2545001	Entrepreneurship	2 SWS	Lecture / 	Terzidis
ST 2024	2545001	Entrepreneurship	2 SWS	Lecture / 	Terzidis, Dang
Exams					
WT 23/24	7900045	Entrepreneurship	Terzidis		
WT 23/24	7900229	Entrepreneurship	Terzidis		
ST 2024	7900002	Entrepreneurship	Terzidis		
ST 2024	7900192	Entrepreneurship	Terzidis		

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

Competence Certificate

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Students are offered the opportunity to earn a grade bonus through separate assignments. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

Prerequisites

None

Recommendation

None

T

6.57 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 23/24	2233810	Environmental Biotechnology	2 SWS	Lecture / 	Tiehm
Exams					
WT 23/24	7232614	Environmental Biotechnology	Tiehm		
ST 2024	7232614	Environmental Biotechnology	Tiehm		

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

Prerequisites

None

T

6.58 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 23/24	2243110	Estimator and Observer Design	2+1 SWS	Lecture / Practice (/ ●)	Jerono
Exams					
WT 23/24	7200007	Estimator and Observer Design	Jerono		
ST 2024	7243110	Estimator and Observer Design	Jerono		

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

T


6.59 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	Membrane Technologies in Water Treatment - Exercises	1 SWS	Practice / 	Horn, Saravia, und Mitarbeiter
Exams					
ST 2024	7233011	Exercises for Membrane Technologies			Horn, Saravia

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

Competence Certificate

Learning control is a completed coursework: Submission of exercises, membrane design and short presentation (5 minutes, group work).

T

6.60 Course: Excursions: Water Supply [T-CIWVT-110866]

Responsible: Dr. Gudrun Abbt-Braun
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 23/24	7232006	Excursions: Water Supply	Abbt-Braun

T

6.61 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 23/24	2211310	Extrusion Technology in Food Processing	2 SWS	Lecture / 	Emin
Exams					
WT 23/24	7200055	Extrusion Technology in Food Processing			Emin

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

Learning control is an oral exam lasting about 20 minutes.

Prerequisites


None.





T

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

Events					
ST 2024	2232820	Flow and Combustion Instabilities in Technical Burner Systems	2 SWS	/ 	Büchner
Exams					
WT 23/24	7231502	Flow and Combustion Instabilities in Technical Burner Systems			Büchner
ST 2024	7231502	Flow and Combustion Instabilities in Technical Burner Systems			Büchner

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

Competence Certificate

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



Prerequisites





None

T

6.63 Course: Fluid Mechanics of Non-Newtonian Fluids [T-CIWVT-108874]

Responsible: Dr.-Ing. Bernhard Hochstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104322 - Fluid Mechanics of Non Newtonian Fluids](#)**Type**
Oral examination**Credits**
8**Grading scale**
Grade to a third**Recurrence**
Each term**Version**
1

Events					
WT 23/24	2242250	Continuum Mechanics and Fluid Mechanics of Non Newtonian Fluids	2 SWS	Lecture / 	Hochstein
ST 2024	2242230	Dimensional Analysis of Fluid Mechanic Problems	2 SWS	Lecture / 	Hochstein
Exams					
WT 23/24	7290204	Fluid Mechanics of Non-Newtonian Fluids			Hochstein
ST 2024	7290204	Fluid Mechanics of Non-Newtonian Fluids			Hochstein

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

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

Prerequisites

None

T

6.64 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	Fluidized Bed Technology	2 SWS	Lecture / 	Rauch
Exams					
WT 23/24	7230012	Fluidized Bed Technology			Rauch
ST 2024	7230012	Fluidized Bed Technology			Rauch

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

Competence Certificate

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

Prerequisites

None

T**6.65 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	Grundlagen der Lebensmittelchemie I	2 SWS	Lecture / 	Bunzel
Exams					
WT 23/24	71109442	Food Chemistry Basics			Bunzel
ST 2024	71109442	Food Chemistry Basics			Bunzel

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

Prerequisites

None

T

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

Responsible: Prof. Dr. Bernhard Watzl
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 winter term

Version
1

Events					
WT 23/24	2211810	Lebensmittelkunde und -funktionalität	2 SWS	Lecture / ✕	N.N.
Exams					
WT 23/24	7220019	Food Science and Functionality	Watzl		
ST 2024	7220019	Food Science and Functionality	Watzl		

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

6.67 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 summer term**Version**
1

Events					
WT 23/24	2214030	Formulation of (Bio)pharmaceutical Therapeutics	2 SWS	Lecture / 	Hubbuch
Exams					
WT 23/24	7223012	Formulation of (Bio)pharmaceutical Therapeutics			Hubbuch
ST 2024	7223012	Formulation of (Bio)pharmaceutical Therapeutics			Hubbuch

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

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

Prerequisites

None

T

6.68 Course: Fuel Technology [T-CIWVT-108829]

Responsible: Prof. Dr.-Ing. Thomas Kolb
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 23/24	2231020	Fuel Technology	2 SWS	Lecture / 	Kolb
WT 23/24	2231021	Exercises on 2231020 Fuel Technology	1 SWS	Practice / 	Kolb, und Mitarbeiter
Exams					
WT 23/24	7230013	Fuel Technology			Kolb
ST 2024	7230013	Fuel Technology			Kolb

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**6.69 Course: Fully Renewable Fuel with Minimal Emission Levels for Marine Engines [T-CIWVT-112256]**

Responsible: Prof. Dr.-Ing. Jörg Sauer
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2231320	Fully Renewable Fuel with Minimal Emission Levels for Marine Engines	2 SWS	Project (P / )	Sauer

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

Competence Certificate

Learning control is an examination of a different kind: report of approx. 20 - 30 pages, (excluding appendix), presentation of the work in a group lecture.

Prerequisites



None.





T

6.70 Course: Fundamentals of Water Quality [T-CIWVT-106838]

Responsible: Dr. Gudrun Abbt-Braun
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103438 - Fundamentals of Water Quality](#)

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2233230	Fundamentals of Water Quality	2 SWS	Lecture / 	Abbt-Braun
WT 23/24	2233231	Fundamentals of Water Quality - Exercises	1 SWS	Practice / 	Abbt-Braun, und Mitarbeiter
Exams					
WT 23/24	7232625	Fundamentals of Water Quality			Abbt-Braun
ST 2024	7232625	Fundamentals of Water Quality			Abbt-Braun

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

Competence Certificate

Written Exam, 90 min
 according to SPO § 4 Abs. 2 Nr. 1.

T

6.71 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 23/24	2212250	Fungal Biology and Biotechnology	2 SWS	Seminar / 	Ochsenreither
Exams					
WT 23/24	7212250-VT-BBP	Fungal Biology Biotechnology	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**6.72 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
Completed coursework	2	pass/fail	Each winter term	1

Events					
WT 23/24	2212250	Fungal Biology and Biotechnology	2 SWS	Seminar / 	Ochsenreither
Exams					
WT 23/24	7212251-S-BBP	Fungal Biology Biotechnology Seminar	Ochsenreither		

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

Competence Certificate

Ungraded coursework: Seminar talk

T

6.73 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 23/24	2244020	Gas Particle Measurement Technology	2 SWS	Lecture / 	Dittler
WT 23/24	2244021	Exercises on 2244020 Gas Particle Measurement Technology	1 SWS	Practice / 	Dittler, und Mitarbeiter
Exams					
WT 23/24	7292918	Gas Particle Measurement Technology			Dittler
ST 2024	7292918	Gas Particle Measurement Technology			Dittler

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

Competence Certificate

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

Prerequisites

None

T

6.74 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 23/24	2244120	Gas Particle Separation Processes	2 SWS	Lecture / 	Meyer
WT 23/24	2244121	Exercises on 2244120 Gas Particle Separation Processes	1 SWS	Practice / 	Meyer
Exams					
WT 23/24	7292939	Gas Particle Separation Processes			Meyer
ST 2024	7292939	Gas Particle Separation Processes			Meyer

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

Competence Certificate

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

Prerequisites

None

T

6.75 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 23/24	2260010	Heat Exchangers	2 SWS	Lecture / 	Wetzel
Exams					
WT 23/24	7280032	Heat Exchangers	Wetzel		
ST 2024	7280032	Heat Exchangers	Wetzel		

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

Competence Certificate

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

Prerequisites

None

T**6.76 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
4

Grading scale
Grade to a third

Version
2



Events					
WT 23/24	2260020	Heat Transfer II	2 SWS	Lecture / 	Wetzel, Dietrich
Exams					
WT 23/24	7280031	Heat Transfer II			Wetzel
ST 2024	7280031	Heat Transfer II			Wetzel





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

T

6.77 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	High Temperature Process Engineering	2 SWS	Lecture / 	Stapf
ST 2024	2232211	High Temperature Process Engineering - Exercises	1 SWS	Practice / 	Stapf, und Mitarbeiter
Exams					
WT 23/24	7231001	High Temperature Process Engineering	Stapf		
ST 2024	7231001	High Temperature Process Engineering	Stapf		

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

None

T

6.78 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	Hydrogen and Fuel Cell Technologies	2 SWS	Lecture / 	Trimis
Exams					
WT 23/24	7231204	Hydrogen and Fuel Cell Technologies			Trimis
WT 23/24	7231204-2	Hydrogen and Fuel Cell Technologies			Trimis
ST 2024	7231204	Hydrogen and Fuel Cell Technologies			Trimis

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

Prerequisites

None

T**6.79 Course: In-depth Module - Doing Culture - Self Assignment BAK [T-ZAK-112655]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).

In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.

The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization. In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T**6.80 Course: In-depth Module - Global Cultures - Self Assignment BAK [T-ZAK-112658]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).

In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.

The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization. In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T**6.81 Course: In-depth Module - Media & Aesthetics - Self Assignment BAK [T-ZAK-112656]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).

In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.

The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization. In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T**6.82 Course: In-depth Module - Spheres of Life - Self Assignment BAK [T-ZAK-112657]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).

In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.

The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization. In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T**6.83 Course: In-depth Module - Technology & Responsibility - Self Assignment BAK [T-ZAK-112654]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate

At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).

In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.

The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization. In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation

The content of the Basic Modul is helpful.

T

6.84 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	Industrial Aspects in Bioprocess Technology	2 SWS	Lecture / 	Hubbuch
Exams					
WT 23/24	7223016	Industrial Aspects in Bioprocess Technology			Hubbuch
ST 2024	7223016	Industrial Aspects in Bioprocess Technology			Hubbuch

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

Competence Certificate

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

Prerequisites

None

T

6.85 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	Industrial Biocatalysis	2 SWS	Lecture / 	Rudat
Exams					
ST 2024	7212230-VT-IBK	Industrial Biocatalysis	Rudat		

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

Competence Certificate

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

Prerequisites

None

T

6.86 Course: Industrial Bioprocesses [T-CIWVT-113120]

Responsible: 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 23/24	2245810	Industrial Bioprocesses	2 SWS	Lecture / 	Kopf
Exams					
WT 23/24	7245810	Industrial bioprocesses			Kopf

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

Competence Certificate

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

Prerequisites

None

T

6.87 Course: Industrial Crystallization [T-CIWVT-108925]

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104364 - Industrial Crystallization](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Exams			
WT 23/24	7280013	Industrial Crystallization	Kind
ST 2024	7280013	Industrial Crystallization	Kind

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

6.88 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	Industrial Genetics	2 SWS	Lecture / 	Ochsenreither
Exams					
ST 2024	7212121-VT-IG	Industrial Genetics	Neumann, Ochsenreither		

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

Prerequisites

None

T

6.89 Course: Industrial Genetics [T-CIWVT-108812]

Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104274 - Industrial Genetics](#)

Type
Oral examination

Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Exams			
WT 23/24	7212121-VT-IG	Industrial Genetics	Neumann, Ochsenreither
ST 2024	7212121-VT-IG	Industrial Genetics	Neumann, Ochsenreither

Prerequisites


None





T

6.90 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	Industrial Wastewater Treatment	2 SWS	Lecture / 	Horn
Exams					
WT 23/24	7232007	Industrial Wastewater Treatment			Horn
ST 2024	7232007	Industrial Wastewater Treatment			Horn

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

Competence Certificate

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



Prerequisites





None

T**6.91 Course: Initial Exam Process Technology and Plant Design [T-CIWVT-106149]**

Responsible: Prof. Dr.-Ing. Thomas Kolb
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 23/24	2231010	Process Technology and Plant Design I	2 SWS	Lecture / 	Kolb, Bajohr
WT 23/24	2231012	Practical Course Process Technology and Plant Design	1 SWS	Practical course / 	Kolb, und Mitarbeiter
Exams					
WT 23/24	7230100				Kolb
WT 23/24	7230100-2	Initial Exam Process Technology and Plant Design			Kolb

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

Competence Certificate

Completed coursework; ungraded exam

Prerequisites

None

T


6.92 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 23/24	2231330	Innovation Management for Products and Processes in the Chemical Industry	2 SWS	Block / 	Sauer, Neumann
Exams					
WT 23/24	7200028	Innovation Management for Products & Processes in the Chemical Industry			Neumann
ST 2024	7231330	Innovation Management for Products & Processes in the Chemical Industry			Neumann

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

Competence Certificate

The examination is a written examination (multiple choice) with a duration of 30 minutes (section 4 subsection 2 number 1 SPO).


Prerequisites





None

T**6.93 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 23/24	2242062	Innovation Project Electronic Devices from Printable Conductive Materials	2 SWS	Project (P / )	Willenbacher

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

Competence Certificate

Learning control is an examination of another type.

Prerequisites


The innovation project can only be chosen in combination with one of the following modules:





- Innovative Concepts for Formulation and Processing of Printable Materials
- Stability of Disperse Systems

T**6.94 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 23/24	2242061	Innovation Project Porous Ceramics from the 3D Printer	2 SWS	Project (P / )	Willenbacher

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


Prerequisites





None.

T

6.95 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 23/24	2242060	Innovative Concepts for Formulation and Processing of Printable Materials	2 SWS	Lecture / 	Willenbacher
Exams					
WT 23/24	7290108	Innovative Concepts for Formulation and Processing of Printable Materials			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

T**6.96 Course: Innovative Food Design by Extrusion Technology [T-CIWVT-112202]**

Responsible: PD Dr.-Ing. Azad Emin
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 23/24	2211320	Innovative Food Design by Extrusion Technology	2 SWS	Project (P / )	Emin
ST 2024	2211320	Innovative Food Design by Extrusion Technology - Part II	2 SWS	Project (P / )	Emin

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



6.97 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	Instrumental Analytics	2 SWS	Lecture /	Guthausen
Exams					
WT 23/24	7291942	Instrumental Analytics			Guthausen
ST 2024	7291942	Instrumental Analysis			Guthausen

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

Competence Certificate

Oral exam, about 30 min

Prerequisites

None

T

6.98 Course: Internship [T-CIWVT-109276]

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104527 - Internship](#)

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (practical)	14	pass/fail	Each term	1

Exams			
WT 23/24	7200000	Internship	Bajohr
ST 2024	7200000	Internship	Bajohr

Prerequisites

None

T**6.99 Course: Introduction to Numerical Simulation of Reacting Flows [T-CIWVT-113436]**

Responsible: Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-106676 - Introduction to Numerical Simulation of Reacting Flows](#)

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

Competence Certificate

The learning control ist an oral examination lasting approx. 30 minutes.

Prerequisites

The prerequisite must be passed before taking the oral examination.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113435 - Introduction to Numerical Simulation of Reacting Flows - Prerequisite](#) must have been passed.

T**6.100 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

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**6.101 Course: Introduction to Sensory Analysis with Practice [T-CIWVT-109128]**

Responsible: Prof. Dr. Katharina Scherf
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	Einführung in die Sensorik mit Übungen	1 SWS	Lecture / 	Stemler
Exams					
WT 23/24	7220016	Introduction to Sensory Analysis with Practice			Scherf
ST 2024	7220016	Introduction to Sensory Analysis with Practice			Scherf


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





Prerequisites

None

T**6.102 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	Journal Club – Novel Bioproduction Systems	2 SWS	Seminar / 	Holtmann
Exams					
ST 2024	7212040-VT-JC	Journal Club - Novel Bioproduction Systems	Holtmann		

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

None.

T

6.103 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	Kinetics and Catalysis	2 SWS	Lecture / 	Wehinger
ST 2024	2220031	Kinetics and Catalysis - Exercises	1 SWS	Practice / 	Wehinger, und Mitarbeiter
Exams					
WT 23/24	7210102	Kinetics and Catalysis	Wehinger, Müller		
ST 2024	7210102	Kinetics and Catalysis	Wehinger		

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

Competence Certificate

Learning control is a written examination lasting 60 minutes.

Prerequisites



None





T

6.104 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 23/24	2245130	NMR for Engineers	2 SWS	Lecture / 	Guthausen
WT 23/24	2245131	Laboratory Work for 2245130 NMR for Engineers	2 SWS	Practical course / 	Guthausen
Exams					
WT 23/24	7291955	Laboratory Work for NMR for Engineers			Guthausen

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

None

T

6.105 Course: Liquid Transportation Fuels [T-CIWVT-111095]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-105200 - Liquid Transportation Fuels](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
WT 23/24	2231130	Liquid Transportation Fuels	2 SWS	Lecture / 	Rauch
WT 23/24	2231131	Exercises on 2231130 Liquid Transportation Fuels	1 SWS	Practice / 	Rauch
Exams					
WT 23/24	7230010	Liquid Transportation Fuels			Rauch
ST 2024	7230020	Liquid Transportation Fuels			Rauch

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

Competence Certificate

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

Prerequisites

None

T

6.106 Course: Mass Transfer II [T-CIWVT-108935]

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
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 23/24	2260220	Mass Transfer II	1 SWS	Lecture / 	Schabel
WT 23/24	2260221	Exercises for 2260220 Mass Transfer II	2 SWS	Practice / 	Schabel, und Mitarbeiter
Exams					
WT 23/24	7280021	Mass Transfer II			Schabel
ST 2024	7280021	Mass Transfer II			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

6.107 Course: Master's Thesis [T-CIWVT-109275]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104526 - Module Master's Thesis](#)

Type	Credits	Grading scale	Recurrence	Version
Final Thesis	30	Grade to a third	Each term	2

Prerequisites

Process Technology and at least three further modules of the advanced fundamentals has to be passed. The internship has to be passed. The examination board decides on exceptions.

(Compare SPO section 14 subsection 1)

Final Thesis

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

Submission deadline 6 months
Maximum extension period 4 weeks
Correction period 8 weeks

T**6.108 Course: Materials and Processes for Electrochemical Storage [T-CIWVT-108146]****Responsible:** Prof. Dr. Jens Tübke**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104353 - Materials and Processes for Electrochemical Storage](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each term**Version**
1

Exams			
WT 23/24	7291840	Materials for Electrochemical Storage	Tübke
ST 2024	7291990	Materials and Processes for Electrochemical Storage	Tübke

Prerequisites

None

T

6.109 Course: Measurement Techniques in Chemical Processing [T-CIWVT-109086]

Responsible: Dr.-Ing. Steffen Peter Müller

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104450 - Measurement Techniques in Chemical Processing \(including practical course\)](#)
[M-CIWVT-104490 - Measurement Techniques in Chemical Processing](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2220330	Messmethoden in der Chemischen Verfahrenstechnik	2 SWS	Lecture / 	Müller
ST 2024	2220331	Praktikum zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik	1 SWS	Practical course / 	Müller
Exams					
WT 23/24	7210107	Measurement Techniques in Chemical Processing			Müller
ST 2024	7210107	Measurement Techniques in Chemical Processing			Müller

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

Competence Certificate



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





Prerequisites

None

T

6.110 Course: Measurement Techniques in the Thermo-Fluid Dynamics [T-CIWVT-108837]**Responsible:** Prof. Dr.-Ing. Dimosthenis Trimis**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104297 - Measurement Techniques in the Thermo-Fluid Dynamics](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

Events					
WT 23/24	2232040	Diagnostics in Thermal Fluid Dynamics	2 SWS	Lecture / 	Trimis
WT 23/24	2232041	Exercises for 2232040 Diagnostics in Thermal Fluid Dynamics	1 SWS	Practice / 	Trimis
Exams					
WT 23/24	7231202	Measurement Techniques in the Thermo-Fluid Dynamics			Trimis
ST 2024	7231202	Measurement Techniques in the Thermo-Fluid Dynamics			Trimis

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

None

T**6.111 Course: Membrane Materials & Processes Research Masterclass [T-CIWVT-113153]****Responsible:** Prof. Dr. Andrea Iris 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 23/24	2233120	Membrane Materials & Processes Research Masterclass	2+2 SWS	Lecture / Practice (/ ●)	Schäfer
Exams					
WT 23/24	7233120	Membrane Materials & Processes Research Masterclass			Schäfer

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

Competence Certificate

Learning control is an examination of another type:

The exam will be composed of contributions during the course and an oral presentation during the full day workshop.

Prerequisites

None

T**6.112 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	Membrane Reactors	2 SWS	Lecture / ✕	Pfeifer
Exams					
WT 23/24	7210213	Membrane Reactors			Pfeifer
ST 2024	7210213	Membrane Reactors			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



6.113 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	Membrane Technologies in Water Treatment	2 SWS	Lecture / 	Horn, Saravia
ST 2024	2233011	Membrane Technologies in Water Treatment - Exercises	1 SWS	Practice / 	Horn, Saravia, und Mitarbeiter
Exams					
WT 23/24	7232605	Membrane Technologies in Water Treatment			Horn, Saravia
ST 2024	7233010	Membrane Technologies in Water Treatment			Horn, Saravia

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

Competence Certificate

Learning control is an written examination lasting 90 minutes.

Prerequisites

Prerequisite: Submission of exercises, membrane design and short presentation (5 minutes, group work).

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-113235 - Exercises: Membrane Technologies](#) must have been passed.

T


6.114 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	Methods and Processes of PGE – Product Generation Engineering	4 SWS	Lecture / 	Albers, Düser
Exams					
WT 23/24	76-T-MACH-105382	Methods and Processes of PGE - Product Generation Engineering			Albers, Burkardt
WT 23/24	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering			Albers
ST 2024	76-T-MACH-105382	Product Development - Methods of Product Development			Albers, Düser
ST 2024	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering			Albers, Düser

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

Competence Certificate

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

Auxiliaries:

- Calculator
- German dictionary (books only)

Prerequisites

None

Annotation

This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

T**6.115 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	Microbiology for Engineers	2 SWS	Lecture / ✕	Schwartz
Exams					
WT 23/24	7232633	Microbiology for Engineers	Schwartz		
ST 2024	7232633	Microbiology for Engineers	Schwartz		

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

T

6.116 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 23/24	2245410	Microfluidics - Basics and Applications	2 SWS	Lecture / 	Leneweit
Exams					
WT 23/24	7291410	Microfluidics			Leneweit
ST 2024	7291410	Microfluidics			Leneweit

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

Competence Certificate

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


Prerequisites





None

T**6.117 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 23/24	2245411	Microfluidics - Basics and Applications with Lab Training	1 SWS	Practical course / 	Leneweit
Exams					
WT 23/24	7291411	Microfluidics - Case Studies			Leneweit
ST 2024	7291965	Microfluidics - Case Studies			Leneweit

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

Prerequisites

None

T

6.118 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	Microrheology and High Frequency Rheology	1 SWS	Lecture / 	Oelschlaeger
Exams					
WT 23/24	7290301	Microrheology and High Frequency Rheology			Oelschlaeger
ST 2024	7290301	Microrheology and High Frequency Rheology			Oelschlaeger

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

Prerequisites

None

T

6.119 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	Mixing, Stirring and Agglomeration	3 SWS	Lecture / 	Rhein
Exams					
WT 23/24	7291907	Mixing, Stirring, Agglomeration			Nirschl, Rhein
ST 2024	7291907	Mixing, Stirring, Agglomeration			Nirschl, Rhein

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

Competence Certificate

Learning control is an oral individual examination with a duration of 30min according SPO section 4, subsection 2.

Prerequisites

None

T

6.120 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	Modelling Wastewater Treatment Processes	4 SWS	Lecture / Practice (/ ●)	Azari Najaf Abad
Exams					
ST 2024	8244112371	Modeling Wastewater Treatment Processes			Azari Najaf Abad

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

Competence Certificate

written report, appr. 10 pages, and presentation, appr. 10 min.

Prerequisites

none


Recommendation





none

Annotation

The number of participants in the course is limited to 20 persons. The registration is made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

T**6.121 Course: Modelling and Simulation of Electrochemical Systems [T-ETIT-100781]****Responsible:** Dr.-Ing. Andre Weber**Organisation:** KIT Department of Electrical Engineering and Information Technology**Part of:** [M-ETIT-100508 - Modelling and Simulation of Electrochemical Systems](#)**Type**
Oral examination**Credits**
3**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

Events					
ST 2024	2304217	Modellbildung elektrochemischer Systeme	2 SWS	Lecture / 	Weber
Exams					
WT 23/24	7304217	Modelling and Simulation of Electrochemical Systems			Weber
ST 2024	7304217	Modelling and Simulation of Electrochemical Systems			Weber



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





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T

6.122 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	Nanoparticles – Structure and Function	2 SWS	Lecture / 	Meyer
ST 2024	2244111	Nanoparticles – Structure and Function - Exercises	1 SWS	Practice / 	Meyer
Exams					
WT 23/24	7292936	Nanoparticles – Structure and Function			Meyer
WT 23/24	7292936-W	Nanoparticles – Structure and Function			Meyer
ST 2024	7292936	Nanoparticles – Structure and Function			Meyer

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

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

Prerequisites

None

T

6.123 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 23/24	2245130	NMR for Engineers	2 SWS	Lecture / 	Guthausen
WT 23/24	2245131	Laboratory Work for 2245130 NMR for Engineers	2 SWS	Practical course / 	Guthausen
Exams					
WT 23/24	7291130	NMR for Engineers			Guthausen
ST 2024	7291954	NMR for Engineers			Guthausen

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

Competence Certificate

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

Prerequisites

Labwork must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course [T-CIWVT-109144 - Laboratory Work for NMR for Engineers](#) must have been passed.

T**6.124 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 23/24	2245130	NMR for Engineers	2 SWS	Lecture / 	Guthausen
Exams					
WT 23/24	7291130	NMR for Engineers	Guthausen		

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

Competence Certificate

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

Prerequisites

None.

T**6.125 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 23/24	2243050	Nonlinear Process Control	2+1 SWS	Lecture / Practice (/ 🎧)	Meurer
Exams					
WT 23/24	7200006	Nonlinear Process Control			Meurer
ST 2024	7243050	Nonlinear Process Control			Meurer

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

Prerequisites

None.



6.126 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	Numerische Methoden in der Strömungsmechanik	2 SWS	Lecture /	Thäter
ST 2024	0103110	Übungen zu 0103100	1 SWS	Practice /	Thäter
ST 2024	0161600	Numerical Methods in Fluidmechanics	2 SWS	Lecture	Dörfler
ST 2024	0164200	Numerische Methoden in der Strömungsmechanik	2 SWS	Lecture	Thäter
ST 2024	0164210	Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik)	1 SWS	Practice	Thäter
Exams					
ST 2024	7700037	Numerical Methods in Fluid Mechanics			Dörfler

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

T

6.127 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	Numerical Simulation of Reacting Multiphase Flows	2 SWS	Lecture / 	Stein
ST 2024	2232121	Numerical Simulation of Reacting Multiphase Flows - Exercises	2 SWS	Practice / 	Stein, und Mitarbeiter
Exams					
ST 2024	7232121	Numerical Simulation of Reacting Multiphase Flows			

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**6.128 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	Numerical Simulation of Reacting Multiphase Flows	2 SWS	Lecture / 	Stein
ST 2024	2232121	Numerical Simulation of Reacting Multiphase Flows - Exercises	2 SWS	Practice / 	Stein, und Mitarbeiter
Exams					
ST 2024	7232120	Numerical Simulation of Reacting Multiphase Flows - Prerequisite			Stein

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

Competence Certificate

The learning control is a completed coursework: Reports on the tutorials documenting the processed task, the data generated and their analysis.

Prerequisites

None

T

6.129 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	Optimal and Model Predictive Control	2 SWS	Lecture / 	Meurer
ST 2024	2243031	Optimal and Model Predictive Control - Exercises	1 SWS	Practice / 	Meurer
Exams					
WT 23/24	7250001	Optimal and Model Predictive Control			Meurer
ST 2024	7243030	Optimal and Model Predictive Control			Meurer

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

T**6.130 Course: Oral Exam - Supplementary Studies on Culture and Society [T-ZAK-112659]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

Exams			
WT 23/24	1200003	Oral Exam - Supplementary Studies on Culture and Society	
ST 2024	1200059	Oral Exam - Supplementary Studies on Culture and Society	

Competence Certificate

An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from In-depth Module.

Prerequisites

Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

T

6.131 Course: Oral Exam - Supplementary Studies on Sustainable Development [T-ZAK-112351]

Organisation:
Part of: [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)
Type
Oral examination

Credits
4

Grading scale
Grade to a third

Version
1

Exams			
WT 23/24	1200011	Oral Exam - Supplementary Studies on Sustainable Development	
ST 2024	1200018	Oral Exam - Supplementary Studies on Sustainable Development	
ST 2024	1200058	Oral Exam - Supplementary Studies on Sustainable Development	

Competence Certificate

An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from Elective Module.

Prerequisites


A requirement for the Supplementary Course: Oral examination is the successful completion of the modules Basics Module and Specialisation Module and the required electives of Elective Module.





T

6.132 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	Organ support systems	2 SWS	Lecture / 	Pylatiuk
Exams					
WT 23/24	76-T-MACH-105228	Organ Support Systems			Pylatiuk
ST 2024	76-T-MACH-105228	Organ Support Systems			Pylatiuk

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

Written examination (Duration: 45min)

Prerequisites

none

T

6.133 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	Particle Technology	2 SWS	Lecture / 	Dittler
ST 2024	2244031	Particle Technology - Exercises	1 SWS	Practice / 	Dittler, und Mitarbeiter
Exams					
WT 23/24	7292975	Particle Technology Exam			Dittler
ST 2024	7292975	Particle Technology Exam			Dittler

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

Competence Certificate

Learning control is a written examination lasting 120 minutes.

Prerequisites

None

T

6.134 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 23/24	5209	Physical Chemistry for Chemical Engineers	2 SWS	Lecture	Meier, Kubar
WT 23/24	5210	Übungen zur Vorlesung Physikalische Chemie für Chemieingenieure	1 SWS	Practice	Meier, Kubar, Assistenten
WT 23/24	5239	Physikalisch-chemisches Praktikum für Chemieingenieure (Master)	2 SWS	Practical course	Bickel, Die Dozenten des Instituts, Unterreiner
Exams					
WT 23/24	718200004P	Physical Chemistry (lab)			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

6.135 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 23/24	5209	Physical Chemistry for Chemical Engineers	2 SWS	Lecture	Meier, Kubar
WT 23/24	5210	Übungen zur Vorlesung Physikalische Chemie für Chemieingenieure	1 SWS	Practice	Meier, Kubar, Assistenten
WT 23/24	5239	Physikalisch-chemisches Praktikum für Chemieingenieure (Master)	2 SWS	Practical course	Bickel, Die Dozenten des Instituts, Unterreiner
Exams					
WT 23/24	71000152_2	Physical Chemistry II (Written Exam)			
WT 23/24	718200004	Physical Chemistry (written exam)	Kubar, Meier, Nattland		
ST 2024	718200104	Physical Chemistry (written exam)	Meier, Kubar		

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**6.136 Course: Physical Foundations of Cryogenics [T-CIWVT-106103]**

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103068 - Physical Foundations of Cryogenics](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2250130	Physical Foundations of Cryogenics	2 SWS	Lecture / 	Grohmann
ST 2024	2250131	Physical Foundations of Cryogenics - Exercises	1 SWS	Practice / 	Grohmann
Exams					
WT 23/24	7250130	Physical Foundations of Cryogenics			Grohmann
ST 2024	7200203	Physical Foundations of Cryogenics			Grohmann

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

Competence Certificate

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

Prerequisites

None

T



6.137 Course: Power-to-X – Key Technology for the Energy Transition [T-CIWVT-111841]





Responsible: Prof. Dr.-Ing. Roland Dittmeyer
Dr. Peter Holtappels

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-105891 - Power-to-X – Key Technology for the Energy Transition](#)

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

Events					
WT 23/24	2220110	Power-to-X – Key Technology for the Energy Transition	2 SWS	Lecture / 	Holtappels, Navarrete Munoz
ST 2024	2220110	Power-to-X: Key Technology for the Energy Transition	2 SWS	Lecture / 	Holtappels, Navarrete Munoz
Exams					
WT 23/24	7220110	Power-to-X – Key Technology for the Energy Transition			Holtappels
ST 2024	7210221	Power-to-X – Key Technology for the Energy Transition			Dittmeyer

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

Competence Certificate

Oral examination lastin approx. 30 minutes.

Prerequisites

None.

T

6.138 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	Practical Course Combustion Technology	3 SWS	Practical course / 	Trimis, Harth
ST 2024	2232321	Laboratory Work in Combustion Technology	3 SWS	Practical course / 	Harth
Exams					
WT 23/24	7231401	Practical Course Combustion Technology			Harth
ST 2024	7231401	Practical Course Combustion Technology			Harth

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

Competence Certificate

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

Prerequisites

None

T


6.139 Course: Practical Course in Water Technology [T-CIWVT-106840]





Responsible: Dr. Gudrun Abbt-Braun
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 23/24	2233032	Practical Course: Water Quality and Water Assessment	2 SWS	Practical course / 	Horn, Abbt-Braun
Exams					
WT 23/24	7232664	Practical Course in Water Technology			Horn, Abbt-Braun, Hille-Reichel
ST 2024	7232664	Practical Course in Water Technology			Horn, Abbt-Braun, 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



6.140 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					
WT 23/24	2220211	Praktikum zu 2220210 Katalytische Mikroreaktoren	1 SWS	Practical course / 	Pfeifer, Dittmeyer, und Mitarbeiter
ST 2024	2220211	Praktikum zu 2220210 Katalytische Mikroreaktoren	1 SWS	Practical course / 	Pfeifer, und Mitarbeiter
Exams					
WT 23/24	7210212	Practical Course Measurement Techniques in Chemical Processing	Pfeifer		
ST 2024	7210212	Practical Course Measurement Techniques in Chemical Processing	Pfeifer		

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

Prerequisites

None

T




6.141 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	Messmethoden in der Chemischen Verfahrenstechnik	2 SWS	Lecture / 	Müller
ST 2024	2220331	Praktikum zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik	1 SWS	Practical course / 	Müller
ST 2024	2220332	Kolloquium zu 2220330 Messmethoden in der Chemischen Verfahrenstechnik		Colloquium (K / 	Müller
Exams					
WT 23/24	7210108	Practical Course Measurement Techniques in Chemical Processing			Müller
ST 2024	7210108	Practical Course Measurement Techniques in Chemical Processing			Müller

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

Competence Certificate

The examination is an ungraded laboratory work (section 4 subsection 3 SPO).

Prerequisites





None

T**6.142 Course: Practical Course Process Technology and Plant Design [T-CIWVT-106148]**

Responsible: Prof. Dr.-Ing. Thomas Kolb
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 23/24	2231012	Practical Course Process Technology and Plant Design	1 SWS	Practical course / 	Kolb, und Mitarbeiter
Exams					
WT 23/24	7230101	practical course Process Technology and Plant Design			Kolb

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

6.143 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 23/24	2220321		1 SWS	Practical course / 	Müller
Exams					
WT 23/24	7210111	Practical Course Sol-Gel Processes			Müller
ST 2024	7210111	Practical Course Sol-Gel Processes			Müller

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


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





Prerequisites

None

T**6.144 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	Practical in Additive Manufacturing for Process Engineering	1 SWS	Practical course / 	Klahn
Exams					
ST 2024	7293102	Practical in Additive Manufacturing for Process Engineering			Klahn

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

T

6.145 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	7210222	Practical in Power-to-X: Key Technology for the Energy Transition	Dittmeyer

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**6.146 Course: Practice Module [T-ZAK-112660]**

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: [M-ZAK-106235 - Supplementary Studies on Culture and Society](#)

Type	Credits	Grading scale	Version
Completed coursework	4	pass/fail	1

Exams			
WT 23/24	1200002	Practice Module	

Competence Certificate

Internship (3 ECT)

Report within the framework of the practical training (Length approx. 18,000 characters (incl. spaces)

(1 ECT)

Prerequisites


none





Annotation

Knowledge from the Basic Module and the Elective Module is helpful.

T

6.147 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]**Responsible:** apl. Prof. Dr. Günter Schell**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-CIWVT-104886 - Principles of Ceramic and Powder Metallurgy Processing](#)**Type**
Oral examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

Events					
WT 23/24	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture / 	Schell
Exams					
WT 23/24	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	Schell, Wagner		
ST 2024	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	Schell		

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

The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites

none

T**6.148 Course: Principles of Constrained Static Optimization [T-CIWVT-112811]**

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-106313 - Principles of Constrained Static Optimization](#)

Type
Oral examination

Credits
4

Grading scale
Grade to a third


Version
1





Events					
WT 23/24	2243060	Principles of Constrained Static Optimization	1+1 SWS	Lecture / Practice (/ 🎧)	Meurer, Jerono
Exams					
WT 23/24	7200054	Principles of Constrained Static Optimization			Jerono
ST 2024	7243060	Principles of Constrained Static Optimization			Jerono

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

T

6.149 Course: Principles of Medicine for Engineers [T-MACH-105235]**Responsible:** apl. Prof. Dr. Christian Pylatiuk**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-MACH-102720 - Principles of Medicine for Engineers](#)**Type**
Written examination**Credits**
4**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

Events					
WT 23/24	2105992	Principles of Medicine for Engineers	2 SWS	Lecture / 	Pylatiuk
Exams					
WT 23/24	76-T-MACH-105235	Principles of Medicine for Engineers			Pylatiuk
ST 2024	76-T-MACH-105235	Principles of Medicine for Engineers			Pylatiuk

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

Written examination (Duration: 45min)

Prerequisites

none


T**6.150 Course: Process Analysis: Modeling, Data Mining, Machine Learning [T-ETIT-111214]**





Responsible: Dr.-Ing. Christian Borchert
Prof. Dr.-Ing. Michael Heizmann

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: [M-ETIT-105594 - Process Analysis: Modeling, Data Mining, Machine Learning](#)

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	4	Grade to a third	Each summer term	1 terms	2

Events					
ST 2024	2302145	Process Analysis: Modeling, Data Mining, Machine Learning	2 SWS	Lecture / 	Borchert
Exams					
ST 2024	7302145	Process Analysis: Modeling, Data Mining, Machine Learning			Borchert

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

T

6.151 Course: Process and Plant Safety [T-CIWVT-108912]

Responsible: Hon.-Prof. Dr. Jürgen Schmidt
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104352 - Process and Plant Safety](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2231810	Process and Plant Safety	2 SWS	Lecture / 	Schmidt
Exams					
WT 23/24	7230200	Process and Plant Safety			Schmidt
ST 2024	7230200	Process and Plant Safety			Schmidt

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

Competence Certificate

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


Prerequisites





None

T**6.152 Course: Process Development in the Chemical Industry [T-CIWVT-108961]**

Responsible: Hon.-Prof. Dr. Jürgen Dahlhaus
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104389 - Process Development in the Chemical Industry](#)

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each summer term	1

Events					
ST 2024	2260810	Process Development in the Chemical Industry	2 SWS	Block / 	Dahlhaus
Exams					
ST 2024	7280041	Process Development in the Chemical Industry			Dahlhaus



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





Prerequisites

None

T**6.153 Course: Process Engineering for the Production of Food from Animal Origins [T-CIWVT-113477]****Responsible:** PD Dr. Volker Gaukel**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-106699 - Process Engineering for the Production of Food from Animal Origins](#)

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

Events					
ST 2024	2211010	Process Engineering for the Production of Food from Animal Origins	2 SWS	Lecture / 	Gaukel
ST 2024	2211011	Process Engineering for the Production of Food from Animal Origins - Question Time	1 SWS	Colloquium (K / 	Gaukel
Exams					
ST 2024	7211010	Process Engineering for the Production of Food from Animal Origins			Gaukel

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





The learning control is an oral examination lasting approx. 30 minutes.

Prerequisites

None

T**6.154 Course: Process Engineering for the Production of Food from Plant-Based Raw Materials [T-CIWVT-113476]****Responsible:** PD Dr. Volker Gaukel**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 23/24	2211010	Verfahren und Prozessketten für Lebensmittel pflanzlicher Herkunft	3+1 SWS	Lecture / 	Karbstein

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

6.155 Course: Process Engineering in Wastewater Treatment [T-BGU-106787]**Responsible:** Dr.-Ing. Tobias Morck**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences**Part of:** [M-BGU-103399 - Process Engineering in Wastewater Treatment](#)

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Competence Certificate

written exam, 60 min.

Prerequisites

internal examination prerequisite: group presentation, appr. 20 min., and written report, appr. 10 pages

Recommendation

none

Annotation

none

T

6.156 Course: Process Instruments and Machinery and Their Process Integration [T-CIWVT-108910]

Responsible: 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 23/24	2245820	Process Instruments and Machinery and Their Process Integration	2 SWS	Block / 	Nagel
Exams					
WT 23/24	7291820	Process Instruments and Machinery and their Process Integration			Nagel

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

Competence Certificate

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

Prerequisites

None

T**6.157 Course: Process Modeling in Downstream Processing [T-CIWVT-106101]**

Responsible: apl. Prof. Dr. Matthias Franzreb
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103066 - Process Modeling in Downstream Processing](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
ST 2024	2214110	Process Modeling in Downstream Processing	2 SWS	Lecture / 	Franzreb
Exams					
WT 23/24	7223015	Process Modeling in Downstream Processing			Franzreb
ST 2024	7223015	Process Modeling in Downstream Processing			Franzreb

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




Prerequisites





None

T**6.158 Course: Process Technology and Plant Design Written Exam [T-CIWVT-106150]**

Responsible: Prof. Dr.-Ing. Thomas Kolb
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104374 - Process Technology](#)

Type	Credits	Grading scale	Recurrence	Version
Written examination	8	Grade to a third	Each term	1

Events					
WT 23/24	2231010	Process Technology and Plant Design I	2 SWS	Lecture / 	Kolb, Bajohr
WT 23/24	2231012	Practical Course Process Technology and Plant Design	1 SWS	Practical course / 	Kolb, und Mitarbeiter
ST 2024	2231011	Process Technology and Plant Design II	3 SWS	Lecture / 	Kolb, Bajohr
Exams					
WT 23/24	7230102	Process Technology and Plant Design Written Exam			Kolb
ST 2024	7230102	Process Technology and Plant Design Written Exam			Kolb

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

Competence Certificate

Learning control is a written examination lasting 180 minutes.

Prerequisites

None




T**6.159 Course: Processes and Process Chains for Renewable Resources [T-CIWVT-108997]**





Responsible: Prof. Dr. Nicolaus Dahmen
Prof. Dr.-Ing. Jörg Sauer

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104422 - Processes and Process Chains for Renewable Resources](#)

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each term	1

Events					
WT 23/24	2231210	Processes and Process Chains for Renewable Resources	2 SWS	Lecture / 	Dahmen, Sauer
WT 23/24	2231211	Exercises on 2231210 Processes and Process Chains for Renewable Resources	1 SWS	Practice / 	Dahmen
ST 2024	2231210	Processes and Process Chains for Renewable Resources	2 SWS	Lecture / Practice (/ 	Dahmen, Sauer
Exams					
WT 23/24	7233101	Processes and Process Chains for Renewable Resources			Dahmen, Sauer
ST 2024	7233101	Processes and Process Chains for Renewable Resources			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**6.160 Course: Processing of Nanostructured Particles [T-CIWVT-106107]****Responsible:** Prof. Dr.-Ing. Hermann Nirschl**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-103073 - Processing of Nanostructured Particles](#)**Type**
Oral examination**Credits**
6**Grading scale**
Grade to a third**Recurrence**
Each winter term**Version**
1

Events					
WT 23/24	2245030	Processing of Nanostructured Particles	2 SWS	Lecture / 	Nirschl
Exams					
WT 23/24	7291030	Processing of Nanostructured Particles			Nirschl
ST 2024	7291921	Processing of Nanostructured Particles			Nirschl

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

None

T

6.161 Course: Product Design II [T-CIWVT-108979]

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104396 - Product Design II](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
WT 23/24	2260141	Product Design II	2 SWS	Lecture / 	Kind
Exams					
WT 23/24	7280014	Product Design II	Kind		
ST 2024	7280014	Product Design II	Kind		

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

Competence Certificate


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





Prerequisites

None

T

6.162 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 23/24	2245420	Production and Development of Cancer Therapeutics	2 SWS	Lecture / 	Leneweit
Exams					
WT 23/24	7291420	Production and Development of Cancer Therapeutics			Leneweit
ST 2024	7291420	Production and Development of Cancer Therapeutics			Leneweit

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

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

Prerequisites

None

T

6.163 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 23/24	2220310	Reaction Kinetics	2 SWS	Lecture / 	Müller
WT 23/24	2220311	Exercises on 2220310 Reaction Kinetics	1 SWS	Practice / 	Müller
Exams					
WT 23/24	7210109	Reaction Kinetics			Müller
ST 2024	7210109	Reaction Kinetics			Müller

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

Competence Certificate

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

Prerequisites

None

T

6.164 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	Reactor Modeling with CFD	1 SWS	Lecture / 	Wehinger, Reinold
ST 2024	2220061	Exercise Reactor Modeling with CFD	2 SWS	Practice / 	Wehinger, und Mitarbeiter
Exams					
ST 2024	7220060	Reactor Modeling with CFD	Wehinger		

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

Prerequisites

None.

T

6.165 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	Refinery Technology - Liquid Fuels	2 SWS	Lecture / 	Rauch
ST 2024	2231121	Refinery Technology - Exercises	1 SWS	Practice / 	Rauch, und Mitarbeiter
Exams					
WT 23/24	7230011	Refinery Technology - Liquid Fuels	Rauch		
ST 2024	7230011	Refinery Technology - Liquid Fuels	Rauch		

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

Competence Certificate

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



Prerequisites





None

T**6.166 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	Refrigeration B	2 SWS	Lecture / 	Grohmann
ST 2024	2250121	Refrigeration B - Exercises	1 SWS	Practice / 	Grohmann, und Mitarbeiter
Exams					
WT 23/24	7250120	Refrigeration B - Foundations of Industrial Gas Processing			Grohmann
ST 2024	7200202	Refrigeration B - Foundations of Industrial Gas Processing			Grohmann

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

Competence Certificate

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

Prerequisites

None

T




6.167 Course: Rheology and Processing of Disperse Systems [T-CIWVT-108891]





Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104336 - Rheology and Processing of Disperse Systems](#)

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each term	1

Events					
WT 23/24	2242030	Stability of Disperse Systems	2 SWS	Lecture / 	Oelschlaeger, Willenbacher
ST 2024	2242040	Rheology of Disperse Systems	1 SWS	Lecture / 	Willenbacher
ST 2024	2242110	Microrheology and High Frequency Rheology	1 SWS	Lecture / 	Oelschlaeger
Exams					
WT 23/24	7290103	Rheology and Processing of Disperse Systems			Willenbacher, Oelschlaeger
ST 2024	7290103	Rheology and Processing of Disperse Systems			Oelschlaeger, Willenbacher

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

Competence Certificate

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

Prerequisites

None

T

6.168 Course: Rheology and Processing of Polymers [T-CIWVT-108890]

Responsible: Dr.-Ing. Bernhard Hochstein
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104335 - Rheology and Processing of Polymers](#)



Type
Oral examination





Credits
8

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2242050	Rheology of Polymers	2 SWS	Lecture / 	Willenbacher
ST 2024	2242240	Rheology and Rheometry	2 SWS	Lecture / 	Hochstein
Exams					
WT 23/24	7290104	Rheology and Processing of Polymers			Willenbacher, Hochstein
ST 2024	7290104	Rheology and Processing of Polymers			Willenbacher, Hochstein

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

Competence Certificate

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

Prerequisites

None

T

6.169 Course: Rheology and Rheometry [T-CIWVT-108881]

Responsible: Dr.-Ing. Bernhard Hochstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104326 - Rheology and Rheometry](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2242240	Rheology and Rheometry	2 SWS	Lecture / 	Hochstein
Exams					
WT 23/24	7290203	Rheology and Rheometry			Hochstein
ST 2024	7290203	Rheology and Rheometry			Hochstein

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

Competence Certificate

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

Prerequisites

None

T

6.170 Course: Rheology of Complex Fluids and Advanced Rheometry [T-CIWVT-108886]

Responsible: Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-104331 - Rheology of Complex Fluids and Advanced Rheometry](#)



Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2242040	Rheology of Disperse Systems	1 SWS	Lecture / 	Willenbacher
ST 2024	2242110	Microrheology and High Frequency Rheology	1 SWS	Lecture / 	Oelschlaeger
Exams					
WT 23/24	7290102	Rheology of Complex Fluids and Advanced Rheometry			Willenbacher, Oelschlaeger
ST 2024	7290102	Rheology of Complex Fluids and Advanced Rheometry			Oelschlaeger, Willenbacher

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

Competence Certificate

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

Prerequisites

None

T**6.171 Course: Rheology of Disperse Systems [T-CIWVT-108963]**

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104391 - Rheology of Disperse Systems](#)


Type
Oral examination





Credits
2

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2242040	Rheology of Disperse Systems	1 SWS	Lecture / 	Willenbacher
Exams					
WT 23/24	7290101	Rheology of Disperse Systems			Willenbacher
ST 2024	7290101	Rheology of Disperse Systems			Willenbacher

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

Prerequisites

None

T

6.172 Course: Rheology of Polymers [T-CIWVT-108884]

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104329 - Rheology of Polymers](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events					
ST 2024	2242050	Rheology of Polymers	2 SWS	Lecture / 	Willenbacher
Exams					
WT 23/24	7290105	Rheology of Polymers			Willenbacher
ST 2024	7290105	Rheology of Polymers			Willenbacher

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

Competence Certificate

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

Prerequisites

None

T

6.173 Course: Selected Formulation Technologies [T-CIWVT-106037]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Dr.-Ing. Nico Leister

Organisation: KIT Department of Chemical and Process Engineering

Part of: [M-CIWVT-103064 - Selected Formulation Technologies](#)

Type
Written examination

Credits
6

Grading scale
Grade to a third

Version
1

Events					
ST 2024	2211030	Trocknen von Dispersionen	1 SWS	Lecture / ✕	Leister, Karbstein
ST 2024	2211031		2 SWS	Lecture / ✕	Leister, Karbstein
ST 2024	2211210		1 SWS	Lecture / ✕	van der Schaaf
Exams					
WT 23/24	7220012	Selected Formulation Technologies			Karbstein
ST 2024	7220012	Selected Formulation Technologies			Leister

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

Competence Certificate

Learning control is a written examination lasting 120 minutes.



Prerequisites





None

T**6.174 Course: Seminar Biotechnological Production [T-CIWVT-108492]**

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
Completed coursework	0	pass/fail	Each summer term	1

Events					
WT 23/24	2212020	Biotechnical Production Methods	2 SWS	Lecture / 	Holtmann
WT 23/24	2212021	Biotechnical Production Methods - Exercises	1 SWS	Seminar / 	Holtmann
Exams					
WT 23/24	7212021-Ü-BS	Seminar Biotechnological Production	Syldatk		

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

Competence Certificate

Completed coursework: Seminar talk.

Prerequisites

None

T

6.175 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			
WT 23/24	7700039	Seminar Mathematics	Kühnlein
ST 2024	7700026	Seminar Mathematics (Vert.)	Kühnlein

T**6.176 Course: Seminar of Food Processing in Practice with Excursion [T-CIWVT-109129]**

Responsible: Dr.-Ing. Ulrike van der Schaaf
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 23/24	2211930	Seminar Food Processing in Practice, incl. Excursion	3 SWS	Block / 	van der Schaaf, Ellwanger, Martin
Exams					
WT 23/24	7220017	Seminar of Food Processing in Practice with Excursion	van der Schaaf		
ST 2024	7220017	Seminar of Food Processing in Practice with Excursion	Gaukel		

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

6.177 Course: SIL Entrepreneurship Project [T-WIWI-110166]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: [M-CIWVT-106017 - Students Innovation Lab](#)

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

Events					
WT 23/24	2545082	SIL Entrepreneurship Project	2-4 SWS	Seminar	Terzidis
ST 2024	2545082	SIL Entrepreneurship Project	2-4 SWS	Seminar / 	Mitarbeiter
Exams					
WT 23/24	7900037	SIL Entrepreneurship Project	Terzidis		

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

Competence Certificate

Alternative exam assessment (§4(2), 3 SPO). The final grade is a result from both, the grade of the term paper and its presentation, as well as active participation during the seminar. In addition, smaller, ungraded tasks are provided in the course to monitor progress.

Prerequisites

None

Recommendation

None

T

6.178 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 23/24	2213030	Single-Cell Technologies	2 SWS	Lecture / 	Grünberger
Exams					
WT 23/24	7213031	Single-Cell Technologies	Grünberger		
ST 2024	7213030	Single-Cell Technologies	Grünberger		

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

Competence Certificate

The learning control is an oral examination.

Prerequisites

None

T

6.179 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 23/24	2220320	Sol-Gel Processes	2 SWS	Lecture / 	Müller
Exams					
WT 23/24	7210110	Sol-Gel Processes			Müller
ST 2024	7210110	Sol-Gel Processes			Müller

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

Competence Certificate

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

Prerequisites

None

T

6.180 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 23/24	2245230	Mechanical Separation Technology	3 SWS	Lecture / 	Gleiß
WT 23/24	2245231	Exercises for 2245230 Mechanical Separation Technology	1 SWS	Practice / 	Gleiß
Exams					
WT 23/24	7291230	Solid Liquid Separation			Gleiß
ST 2024	7291987	Solid Liquid Separation			Gleiß

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

Competence Certificate

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

Prerequisites

None



6.181 Course: Specialisation Module - Self Assignment BeNe [T-ZAK-112346]

Responsible: Christine Myglas

Organisation:

Part of: [M-ZAK-106099 - Supplementary Studies on Sustainable Development](#)

Type	Credits	Grading scale	Version
Examination of another type	6	Grade to a third	1

Competence Certificate

The monitoring occurs in the form of several supplementary courses, which usually comprise a presentation of the (group) project, a written elaboration of the (group) project as well as an individual term paper, if necessary with appendices (examination performances of other kind according to statutes § 5 section 3 No. 3 or § 7 section 7).

The presentation is usually with the accompanying practice partners, as well as the written paper.

Prerequisites

Active participation in all three mandatory components.

Self service assignment of supplementary studies

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation

Knowledge from 'Basic Module ' and 'Elective Module ' is helpful.

T

6.182 Course: Stability of Disperse Systems [T-CIWVT-108885]

Responsible: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104330 - Stability of Disperse Systems](#)


Type
Oral examination





Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
WT 23/24	2242030	Stability of Disperse Systems	2 SWS	Lecture / 	Oelschlaeger, Willenbacher
Exams					
WT 23/24	7290106	Stability of Disperse Systems			Willenbacher
ST 2024	7290106	Stability of Disperse Systems			Willenbacher

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

Competence Certificate

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

Prerequisites

None

T

6.183 Course: Statistical Thermodynamics [T-CIWVT-106098]



Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-103059 - Statistical Thermodynamics](#)





Type
Oral examination

Credits
6

Grading scale
Grade to a third

Version
1

Events					
ST 2024	2250040	Statistical Thermodynamics	2 SWS	Lecture / 	Enders
ST 2024	2250041	Statistical Thermodynamics - Exercises	1 SWS	Practice / 	Enders
Exams					
WT 23/24	7200103	Statistical Thermodynamics			Enders
ST 2024	7200103	Statistical Thermodynamics			Enders

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


Competence Certificate





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

Prerequisites

Thermodynamics III

T**6.184 Course: Structure and Reaction of Aquatic Humic Substances [T-CIWVT-108842]****Responsible:** Dr. Gudrun Abbt-Braun**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104302 - Structure and Reaction of Aquatic Humic Substances](#)**Type**
Oral examination**Credits**
2**Grading scale**
Grade to a third**Recurrence**
Each summer term**Version**
1

Events					
ST 2024	2233220	Structur and Reactions of Aquatic Humic Substances	1 SWS	Lecture / 	Abbt-Braun
Exams					
WT 23/24	7232615	Structure and Reaction of Aquatic Humic Substances			Abbt-Braun
ST 2024	7232615	Structure and Reaction of Aquatic Humic Substances			Abbt-Braun

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**6.185 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

6.186 Course: Thermal Separation Processes II [T-CIWVT-108926]

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104365 - Thermal Separation Processes II](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
WT 23/24	2260120	Thermal Separation Processes II	2 SWS	Lecture / 	Kind
WT 23/24	2260121	Exercises for 2260120 Thermal Separation Processes II	1 SWS	Practice / 	Kind
Exams					
WT 23/24	7280012	Thermal Separation Processes II			Kind
ST 2024	7280012	Thermal Separation Processes II			Kind

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

6.187 Course: Thermal Transport Processes [T-CIWVT-106034]

Responsible: Prof. Dr.-Ing. Matthias Kind
 Prof. Dr.-Ing. Wilhelm Schabel
 Prof. Dr.-Ing. Thomas Wetzel

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	Thermal Transport Processes	2 SWS	Lecture / 	Schabel, Wetzel
ST 2024	2260151	Thermal Transport Processes - Exercises	2 SWS	Practice / 	Schabel, Wetzel, und Mitarbeiter
Exams					
WT 23/24	7280011	Thermal Transport Processes	Kind, Wetzel		
ST 2024	7280011	Thermal Transport Processes	Wetzel		

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

Competence Certificate

Learning control is a written examination lasting 180 minutes.

Prerequisites

None

T

6.188 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 23/24	2250030	Thermodynamics III	2 SWS	Lecture / 	Enders
WT 23/24	2250031	Thermodynamics III - Exercises	1 SWS	Practice / 	Enders, und Mitarbeiter
Exams					
WT 23/24	7200104	Thermodynamics III			Enders
ST 2024	7200104	Thermodynamics III			Enders

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

Competence Certificate

Learning control is a written examination lasting 90 minutes.

Prerequisites

None

T

6.189 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	Thermodynamics of Interfaces	2 SWS	Lecture / 	Enders
Exams					
WT 23/24	7200102	Thermodynamics of Interfaces			Enders
ST 2024	7200102	Thermodynamics of Interfaces			Enders



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





Competence Certificate

Erfolgskontrolle ist eine mündliche Prüfung im Umfang von 30 Minuten.

T**6.190 Course: Unit Operations and Process Chains for Food of Animal Origin [T-CIWVT-108996]****Responsible:** Prof. Dr.-Ing. Heike Karbstein**Organisation:** KIT Department of Chemical and Process Engineering**Part of:** [M-CIWVT-104421 - Unit Operations and Process Chains for Food of Animal Origin](#)

Type	Credits	Grading scale	Recurrence	Version
Oral examination	5	Grade to a third	Each summer term	3

Events					
ST 2024	2211010	Process Engineering for the Production of Food from Animal Origins	2 SWS	Lecture / 	Gaukel
ST 2024	2211011	Process Engineering for the Production of Food from Animal Origins - Question Time	1 SWS	Colloquium (K / 	Gaukel
Exams					
WT 23/24	7220015	Unit operations and process chains for food of animal origin			Karbstein
ST 2024	7220015	Unit operations and process chains for food of animal origin			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**6.191 Course: Unit Operations and Process Chains for Food of Plant Origin [T-CIWVT-108995]**

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104420 - Unit Operations and Process Chains for Food of Plant Origin](#)


Type
Oral examination





Credits
7

Grading scale
Grade to a third

Recurrence
Each winter term

Version
2

Events					
WT 23/24	2211010	Verfahren und Prozessketten für Lebensmittel pflanzlicher Herkunft	3+1 SWS	Lecture / 	Karbstein
Exams					
WT 23/24	7220009	Unit operations and process chains for food of plant origin			Karbstein
ST 2024	7220009	Unit operations and process chains for food of plant origin			Gaukel

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

6.192 Course: Vacuum Technology [T-CIWVT-109154]

Responsible: Dr. Christian Day**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 23/24	2250810	Vacuum Technology	2 SWS	Lecture / 	Day
WT 23/24	2250811	Vacuum Technology - Exercises	1 SWS	Practice / 	Day, Varoutis
Exams					
WT 23/24	7200401	Vacuum Technology			Day
ST 2024	7200401	Vacuum Technology			Day

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

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

Prerequisites

None

T

6.193 Course: Wastewater Treatment Technologies [T-BGU-109948]

Responsible: Dr.-Ing. Mohammad Ebrahim Azari Najaf Abad
PD Dr.-Ing. Stephan Fuchs

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

Part of: [M-BGU-104917 - Wastewater Treatment Technologies](#)

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	4

Events					
WT 23/24	6223801	Wastewater Treatment Technologies	4 SWS	Lecture / Practice (/ 🎧)	Fuchs, Azari Najaf Abad
Exams					
WT 23/24	8244109948	Wastewater Treatment Technologies			Fuchs, Azari Najaf Abad
ST 2024	8244109948	Wastewater Treatment Technologies			Fuchs, Azari Najaf Abad

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

Competence Certificate

written exam, 60 min.

Prerequisites

none

Recommendation


none





Annotation

The number of participants in the course is limited to 30 persons. The registration is to be made via ILIAS. The places are allocated considering the progress in the students' studies, with priority to students from *Water Science and Engineering*, then *Civil Engineering*, *Chemical and Process Engineering*, *Geoecology* and further study programs.

T**6.194 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	Circular Economy Water Energy Environment: Research Proposal Preparation	4 SWS	Lecture / 	Schäfer
Exams					
ST 2024	7233130	Water – Energy – Environment Nexus in a Circular Economy: Research Proposal Preparation			Schäfer

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

The Learning control is an examination of another type:

Research proposal of 10 pages and an oral presentation of 10 minutes (individual work). The grade will be a composite of the proposal (submission in week 13 before class) and oral & poster presentation (all day workshop with researcher participation).

Prerequisites

None

T

6.195 Course: Water Quality Assessment [T-CIWVT-108841]

Responsible: Dr. Gudrun Abbt-Braun
Organisation: KIT Department of Chemical and Process Engineering
Part of: [M-CIWVT-104301 - Water Quality Assessment](#)



Type
Oral examination





Credits
6

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events					
WT 23/24	2233210	Scientific Principles for Water Quality Assessment	2 SWS	Lecture / 	Abbt-Braun
WT 23/24	2233211	Exercises and Demonstration for 2233210 Scientific Principles for Water Quality Assessment	1 SWS	Practice / 	Abbt-Braun, Horn, und Mitarbeiter
Exams					
WT 23/24	7232603	Water Quality Assessment	Abbt-Braun		
ST 2024	7232603	Water Quality Assessment	Abbt-Braun		

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

6.196 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 23/24	2233030	Water Technology	2 SWS	Lecture / 	Horn
WT 23/24	2233031	Exercises to Water Technology	1 SWS	Practice / 	Horn, und Mitarbeiter
Exams					
WT 23/24	7232621	Water Technology			Horn
ST 2024	7232621	Water Technology			Horn

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