Karlsruher Institut für Technologie

Module Handbook
Bioengineering Bachelor 2023 (Bachelor of Science (B.Sc.))

SPO 2023

Summer term 2024

Date: 04/03/2024

KIT DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

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1 General Information

1.1 Study program details

KIT-Department	KIT Department of Chemical and Process Engineering
Academic Degree	Bachelor of Science (B.Sc.)
Examination Regulations Version	2023
Regular terms	6 terms
Maximum terms	12 terms
Credits	180
Language	Deutsch
Grade calculation	Weighted by (Weight * CP)
Additional Information	Link to study program www.ciw.kit.edu Department https://www.ciw.kit.edu/1628.php Business unit Studium und Lehre https://www.sle.kit.edu/vorstudium/bachelor-bioingenieurwesen.php

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 Bachelor’s program provides knowledge on scientific fundamentals and methodical expertise in the area of bioengineering. The Bachelor’s degree will qualify students to apply the acquired theoretical knowledge to a specific professional field. Furthermore, students will gain the knowledge and skills that are necessary to complete a Master's program successfully.

The compulsory program in the first and second year focuses on methodical and qualified fundamental knowledge of mathematics, natural sciences, biotechnology and engineering. The main focus is on process engineering of biological material systems, reactions and processes in theory (basic lectures) and practice (introductory laboratory courses).

The knowledge acquired in the first and second year is not only the basis for the third year of the Bachelor’s program, but also for the following Master’s studies. Mandatory elective courses in the third year of study offer the opportunity to gain in-depth knowledge in a specialist area for the first time. These mandatory elective courses comprise technological aspects and a practical project work (group work). Within their Bachelor's thesis, students prove the ability of working on specialized problems independently and within a defined time frame using scientific methods.

Graduates are qualified to identify, abstract, and solve technical problems using the basic knowledge provided during the Bachelor’s program. Furthermore, they can evaluate biotechnological products and processes systematically as well as select and apply analyzing and simulation tools. They are able to combine theory and practice as well as to organize and implement projects independently. Graduates are able to collaborate with experts in other fields.

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 Bachelorstudiengang Bioingenieurwesen

(Study and Examination Regulations of the Karlsruhe Institute of Technology (KIT) for the Bachelor Course of Studies in Chemical and Process Engineering)

of 27 April 2023.

1.4 Organizational issues

General Information

Current information on degree programs and dates for information sessions can be found on the faculty web pages. http://www.ciw.kit.edu/english/studium.php

Recognition of achievements according to § 19 SPO

A request for recognition of services which

- At another university
- Abroad
- Outside the higher education system

can be submitted to the Bachelor 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.

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

Additional achievements and interdisciplinary (soft skill) 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 Julia Hofer 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/bpa.php

2 Curriculum Bachelor Bioengineering

2.1 Semester overview

Semester CP	Fundamentals of Mathematics and Natural Sciences	Fundamentals of Scientific Engineering	Fundamentals of Process Engineering	Specialization/ Process Engineering	Specialization/ Project Work; Interdicliplinary Qualification; Thesis
1 **29**	Advanced Mathematics I (7) General Chemistry and Chemistry of Aqueous Solutions (6) Biology für Engineers (7) - Cell Biology - Biochemistry - Genetics Basic Pracital Course (4) - Generyl Chemistry - Mikrobiology	Engineering Mechanics: Statics (5)			
2 **33**	Advanced Mathematics II (7) Mathematical Modeling for Biochemical Engineering (4) Organic Chemistry (5) Biology für Engineers (2) - Microbiology	Design of Machines (7)	Introduction into Bioengineering (5)		Programming and Numeric Simulation Using MATLAB (3)
3 **29**	Advanced Mathematics III (7) Data Analysis (3)	Engineering Mechanics: Dynamics (5) Thermodynamics I (7)	Bioprocess Engineering (5)		Scientific Writing with LaTeX (2)
4 **33**		Thermodynamics II (7) Heat and Mass Transfer (7) Fluiddynamics (5) Control Engineering and System Dynamics (5)		Elective Module Bioprocess Engineering (including lab) I (9)	
5 **28**			Unit Operations: Two modules (2 X 6)	Elective Module Bioprocess Engineering (including lab) (9) Elective Module Process Engineering I (5)	Specialization/ Project Work (2)
6 **28**				Elective Module Process Engineering II (5)	Specialization/ Project Work (10) Interdiciplinary Qualification (1) Thesis (12)

Numbers in brackets: Credits Points (CP)

Elective Module Bioprocess Engineering I and II: Lecture/ written exam (6 LP), lab one week (3 LP), the following modules can be chosen:

- Intensification of Bioprocesses
- Food Bioprocess Engineering
- Biopharmaceutical Process Engineering
- Microsystems in Bioprocess Engineering

2.2 Overview: Fields and Modules

Area	Module	Responsible	SWS	CP
Fundamentals of Mathematics and Natural Sciences 52 CP	Advanced Mathematics I	Griesmaier	6	7
	Advanced Mathematics II	Griesmaier	6	7
	Advanced Mathematics III	Griesmaier	6	7
	Mathematical Modeling for Biochemical Engineering	Thäter	2	4
	Data Analysis	Guthausen	2	3
	General Chemistry/ Chemistry of Aq. Solutions	Horn	5	6
	Organic Chemistry	Meier	4	5
	Biology for Engineers	Holtmann	8	9
	Basic Practical Course	Abbt-Braun, Horn, Neumann	2	4
Fundamentals of Scientific Engineering 48 CP	Engineering Mechanics: Statics	Willenbacher	4	5
	Engineering Mechanics: Dynamics	Dittmeyer	4	5
	Design of Machines	Nirschl	6	7
	Control Engineering and System Dynamics	Meurer	4	5
	Thermodynamics I	Enders	5	7
	Thermodynamics II	Enders	5	7
	Fluiddynamics	Nirschl	4	5
	Heat and Mass Transfer	Wetzel	5	7
Fundamentals of Process Engineering 22 LP	Introduction into Bioengineering	Grünberger	4	5
	Bioprocess Engineering	Grünberger	4	5
	Two oft he following modules:			
	- Mechanical Processing	Dittler	4	6
	- Thermal Process Engineering	Kind	4	6
	- Chemical Process Engineering	Wehinger	4	6
Specialization/ Process Engineering 28 LP	Elective Module Bioprocess Engineering I		4 + P	9
	Elective Module Bioprocess Engineering II		4 + P	9
	Elective Module Process Engineering I		4	5 (6)
	Elective Module Process Engineering I		4	5 (4)
Interdicliplinary Qualification 6 LP	Programming and Numeric Simulation Using MATLAB	Meurer	2	3
	Scientific Writing with LaTeX			2
	Elective module			1
Specialization/ Project Work 12 LP	1 module			12
12 LP	Thesis			12
Total				180

CP: Credit Points (ECTS), SWS: weekly teaching hours

2.3 Lectures/ Exercises/ Laboratories/ exams

(Semester Overview, Attendance Timehours per week)

	1. Semester (WS)					2. Semester (SS)				
	V	Ü	P	LP	E	V	Ü	P	LP	E
Advanced Mathematics I and II	4	2	-	7	S+K	4	2	-	7	S+K
Mathematical Modeling for Biochemical Engineering	-	-	-	-	-	2	1		4	A
Engineering Mechanics: Statics	2	2	-	5	K	-	-	-	-	-
Design of Machines	-	-	-	-	-	3	2	-	7	S+K
General Chemistry and Chemistry in Aqu. Solutions	3	2	-	6	K		-	-	-	-
Organic Chemistry	-	-	-	-	-	2	2	-	5	K
Biology for Engineers – Cell Biology	2	-	-	2	K	-	-	-	-	-
Biology for Engineers - Biochemistry	2	-	-	2,5	K	-	-	-	-	-
Biology for Engineers - Mikrobiology	2	-	-	2,5	K	-	-	-	-	-
Biology for Engineers – Genetcs	-	-	-	-	-	2	-	-	2	K
Introduction into Bioengineering	-	-	-	-	-	2	2	-	5	K
Basic Practical Course in Natural Sciences	-	-	4	4	S	-	-	-	-	-
Programming and Numeric Simulation Using MATLAB	-	-	-	-	-	1	1	-	3	S
Total credit points/ Number of graded exams				29	6				33	6

	3. Semester (WS)					4. Semester (SS)				
	V	Ü	P	LP	E	V	Ü	P	LP	E
Advanced Mathematics III	4	2	-	7	S+K	-	-	-	-	-
Data Analysis	1	1	-	3	A	-	-		-	-
Engineering Mechanics: Dynamics	2	2	-	5	S+K	-	-	-	-	-
Control Engineering and System Dynamics	-	-	-	-	-	2	2	-	5	K
Fluiddynamics	-	-	-	-	-	2	2	-	5	S+K
Thermodynamics I and II	3	2	-	7	S+K	3	2	-	7	S+K
Heat and Mass Transfer	-	-	-	-	-	3	2	-	7	K
Bioprocess Engineering	2	2	-	5	K	-	-	-	-	-
Elective Module Bioprocess Engineering I	-	-	-	-	-	2	2	2	9	K+P
Scientific Writing with LaTeX	1	1	-	2	S					
Total credit points/ Number of graded exams				29	5				33	6

	5. Semester (WS)					6. Semester (SS)				
	V	Ü	P	LP	E	V	Ü	P	LP	E
Chemical/ Thermal/ Mechanical Process Engineering	2	2	-	6	K	-	-	-	-	-
Chemical/ Thermal/ Mechanical Process Engineering	2	2	-	6	K	-	-		-	-
Eletive Module Bioprocess Engineering II	2	2	2	9	K+P	-	-	-	-	-
Elective Module Process Engineering	2	2	-	5	K	2	2	-	5	K
Specialized Subject/ Project Work	1	1	-	2	-	1	1	P	10	A+M
Interdisciplinary Qualification	-	-	-	-	-	1	-	-	1	S
Thesis	-	-	-	-	-	360 Stunden			12	A
Total credit points/ Number of graded exams				28	5				28	4

WS: Winter term
SS: Summer term
V: Lecture
Ü: Exercies
P: Lab
CP: Credit Points (ECTS)
E: Exam
K: Written Exam
M: Oral Exam
A: Examination of another type/ thesis
S: Completed Courswork (ungraded)

3 Field of study structure

Mandatory	
Orientation Exam *This field will not influence the calculated grade of its parent.*	
Bachelor's Thesis	12 CR
Fundamentals of Mathematics and Natural Sciences	52 CR
Fundamentals of Scientific Engineering	48 CR
Fundamentals of Process Engineering	22 CR
Specialization/ Process Engineering	28 CR
Specialization/ Project Work	12 CR
Interdisciplinary Qualifications	6 CR
Voluntary	
Additional Examinations *This field will not influence the calculated grade of its parent.*	
Master's Transfer Account *This field will not influence the calculated grade of its parent.*	

3.1 Orientation Exam

Mandatory		
M-CIWVT-106447	Orientation Exam	0 CR

3.2 Bachelor's Thesis

Credits
12

Prerequisite:

The Bachelor thesis may only be started when the requirements (at least 120 LP) have been fulfilled.

Procedure for registering the Bachelor's thesis

Registration for the Bachelor's thesis is handled by the Bachelor Examination Board:

- Registration before starting the thesis
- If possible, send documents to the Bachelor Examination Board via the Institute Secretariat.
- The Bachelor Examination Board requires the following documents no later than four weeks after the start of the work
  - Admission certificate https://www.ciw.kit.edu/1838.php filled out and signed
  - Copy of the assignment (signed by the person submitting the assignment)
- The Bachelor Examination Board will record and register the Bachelor thesis in the campus management system. The deadline for submission is also recorded by the Bachelor Examination Board.

Submission of the Bachelor's thesis:

- The maximum processing time is four months. The submission deadline is recorded in the campus management system. The thesis must be handed in within the deadline.
- When submitting the Bachelor's thesis, students must declare that they have written the thesis independently and have not used any sources or aids other than those specified. The exact wording can be found in the study and examination regulations.
  - pdf-File, upload
  - Handing in at the supervisor after consultation
- The date of submission is the date of upload.

Mandatory		
M-CIWVT-106580	Module Bachelor's Thesis	12 CR

3.3 Fundamentals of Mathematics and Natural Sciences

Credits
52

Mandatory		
M-MATH-100280	Advanced Mathematics I	7 CR
M-CIWVT-106414	Biology for Engineers	9 CR
M-CIWVT-106431	General Chemistry and Chemistry of Aqueous Solutions	6 CR
M-CIWVT-106427	Basic Practical Course in Natural Sciences	4 CR
M-MATH-106443	Mathematical Modeling for Biochemical Engineering	4 CR
M-MATH-100281	Advanced Mathematics II	7 CR
M-CHEMBIO-101115	Organic Chemistry for Engineers	5 CR
M-MATH-100282	Advanced Mathematics III	7 CR
M-CIWVT-106432	Data Analysis	3 CR

3.4 Fundamentals of Scientific Engineering

Credits
48

Mandatory		
M-CIWVT-105846	Engineering Mechanics: Statics	5 CR
M-CIWVT-101128	Engineering Mechanics: Dynamics	5 CR
M-CIWVT-101941	Design of Machines	7 CR
M-CIWVT-101129	Thermodynamics I	7 CR
M-CIWVT-106308	Control Engineering and System Dynamics	5 CR
M-CIWVT-101130	Thermodynamics II	7 CR
M-CIWVT-101131	Fluiddynamics	5 CR
M-CIWVT-101132	Fundamentals of Heat and Mass Transfer	7 CR

3.5 Fundamentals of Process Engineering

Credits
22

Mandatory		
M-CIWVT-106433	Introduction into Bioengineering	5 CR
M-CIWVT-106434	Bioprocess Engineering	5 CR
Unit Operations (Election: 12 credits)		
M-CIWVT-101134	Thermal Process Engineering	6 CR
M-CIWVT-101135	Mechanical Processing	6 CR
M-CIWVT-101133	Chemical Process Engineering	6 CR

3.6 Specialization/ Process Engineering

Credits
28

Specialization Bioprocess Engineering (Election: 18 credits)		
M-CIWVT-106437	Biopharmaceutical Process Engineering	9 CR
M-CIWVT-106416	Intensification of Bioprocesses	9 CR
M-CIWVT-106436	Food Bioprocess Engineering	9 CR
Specialization Process Engineering (Election: at least 10 credits)		
M-CIWVT-106475	Biopharmaceutical Process Engineering	6 CR
M-CIWVT-101136	Energy Process Engineering	5 CR
M-CIWVT-106444	Intensification of Bioprocesses	6 CR
M-CIWVT-106476	Food Bioprocess Engineering	6 CR
M-CIWVT-101137	Industrial Organic Chemistry	5 CR
M-ETIT-105690	Electrochemical Energy Technologies *First usage possible from 4/1/2024.*	5 CR

3.7 Specialization/ Project Work

Credits
12

In the fifth semester the possibility of profile building exists for the first time. Eleven specialization subjects are available. The size and structure of these specialization subjects are similar. All specialization subjects extend over two semesters, start in the winter semester and end at the end of May at the latest. In the winter semester, lectures usually take place in which extended, subject-specific knowledge is imparted. Subsequently, research-related project work is carried out in small groups. Prerequisites for participation in the profile subjects are at least 60 ECTS and at least one successfully completed internship (e.g. general and inorganic chemistry, process engineering,...).

The learning control of specialization subjects consists of two parts which are listed in the description of the module description (e.g. oral examination and presentation of the project work). The specialization subject is only passed if both partial examinations are passed (evaluated with at least "sufficient"). A failed partial performance can only be repeated once. Dates for repeat exams will be agreed with the person responsible for the subject.

As the practical work is carried out in the laboratory, the number of participants in the individual specialization subjects is limited. The registration for the specialization subjects is usually possible in June or July. Within a registration period of two weeks, students have the opportunity to choose their preferred subject (at least one first and one second wish). After the registration deadline, the places will be allocated automatically, taking into account your wishes as far as possible.

Before the start of the registration period, an information event will be held in which the individual subjects will be presented and the registration procedure explained.

Election regulations
Elections in this field require confirmation.

Specialization/ Project Work (Election: 1 item)		
M-CIWVT-106477	Automation and Control Systems Engineering	12 CR
M-CIWVT-101143	Biotechnology	12 CR
M-CIWVT-101145	Energy and Environmental Engineering	12 CR
M-CIWVT-104457	Fundamentals of Refrigeration	12 CR
M-CIWVT-105995	Circular Economy	12 CR
M-CIWVT-101148	Food Technology	12 CR
M-CIWVT-106448	Air Pollution Control	12 CR
M-CIWVT-101147	Mechanical Separation Technology	12 CR
M-CIWVT-101154	Micro Process Engineering	12 CR
M-CIWVT-101153	Process Development and Scale-up	12 CR

3.8 Interdisciplinary Qualifications

Credits
6

A total of 6 LPs must be completed in the area of "soft skill qualifications" during the Bachelor's programe. Non-technical modules, such as modules from other subject areas, language courses or other courses offered by the House of Competence (HoC) or the Centre for Applied Cultural Studies and General Studies (ZaK), belong to interdisciplinary qualifications.

Mandatory		
M-CIWVT-106438	Programming and Numeric Simulation	3 CR
M-HOC-106502	Scientific Writing with LaTeX	2 CR

3.9 Additional Examinations

Additional Examinations (Election: at most 30 credits)		
M-CIWVT-102017	Further Examinations	30 CR
M-ZAK-106099	Supplementary Studies on Sustainable Development	19 CR
M-ZAK-106235	Supplementary Studies on Culture and Society	22 CR

3.10 Master's Transfer Account

Students who have already earned at least 120 LP in their Bachelor's programe can earn credit points from a consecutive Master's programe at KIT up to a maximum of 30 LP.

Exams can be taken in the following subjects:

- Advanced Fundamentals
- Internship
- Soft Skill Qualifications

Further information on individual modules can be found in the module manual of the Master's program.

Within the first Master's semester, achievements can be taken over into the master program. Please contact the Master's Examination Board.
There is no obligation to transfer achievements form Master Transfer Account!

Election notes
Please note: Upon successful completion of all studies and exams needed for the bachelor’s degree, a control of success registered as a prior master’s examination may only be passed as long as you are enrolled in the bachelor’s program. You should not yet have been admitted to the master’s program and the master’s semester should not yet have started.

This means that as soon as your admission to the master’s program has been expressed and the master’s semester has started, your participation in the examination is the **first regular examination** attempt within the framework of your master’s studies.

Master Transfer Account (Election: at most 30 credits)		
M-CIWVT-101991	Single Results	30 CR

Modelled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in your course of studies.

4 Modules

M 4.1 Module: Automation and Control Systems Engineering [M-CIWVT-106477]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

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

Mandatory			
T-CIWVT-113088	Automation and Control Systems Engineering - Exam	6 CR	Meurer
T-CIWVT-113089	Automation and Control Systems Engineering - Project Work	6 CR	Meurer

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

M 4.2 Module: Advanced Mathematics I [M-MATH-100280]

Responsible: Prof. Dr. Roland Griesmaier
Organisation: KIT Department of Mathematics
Part of: Fundamentals of Mathematics and Natural Sciences

Credits	Grading scale	Duration	Language	Level	Version
7	Grade to a tenth	1 term	German	3	3

Mandatory			
T-MATH-100275	Advanced Mathematics I	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100525	Tutorial Advanced Mathematics I *This item will not influence the grade calculation of this parent.*	0 CR	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried by a written examination of length 120 minutes and by homework assignments (pre-requesite). A "pass" result on the pre-requesite is a requirement for registration for the corresponding written examination.

Prerequisites
none

Competence Goal
The students know the fundamentals of one-dimensional calculus. They can reliably use limits, functions, power series and integrals. They understand central concepts such as continuity, differentiability or integrability and they know important statements about these concepts. The students can follow the arguments leading to these statements as presented in the lectures and are able to independently prove simple assertions based on these statements.

Content
Fundamentals, sequences and convergence, functions and continuity, series, differential calculus of one real variable, integral calculus

Module grade calculation
The module grade is the grade of the written examination

Workload
In class: 90 hours

- lectures, tutorials and examinations

Independent study: 120 hours

- independent review of course material
- work on homework assignments
- preparation for written exams

Literature
will be announced in class.

Base for
Advanced Mathematics II

M 4.3 Module: Advanced Mathematics II [M-MATH-100281]

Responsible: Prof. Dr. Roland Griesmaier
Organisation: KIT Department of Mathematics
Part of: Fundamentals of Mathematics and Natural Sciences

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	Each summer term	1 term	German	3	2

Mandatory			
T-MATH-100276	Advanced Mathematics II	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100526	Tutorial Advanced Mathematics II *This item will not influence the grade calculation of this parent.*	0 CR	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried by a written examination of length 120 minutes and by homework assignments (pre-requesite). A "pass" result on the pre-requesite is a requirement for registration for the corresponding written examination.

Prerequisites
none

Competence Goal
The students know about the fundamentals of linear algebra. The are able to use vectors, linear maps and matrices without problems. They have basic knowledge about Fourier series. The students also can theoretically and practically deal with initial value problems of ordinary differential equations. They can make use of classical solution techniques for linear differential equations.

Content
vector spaces, linear maps, eigenvalues, Fourier series, differential equations, Laplace transform

Module grade calculation
The module grade is the grade of the written examination.

Workload
In class: 90 hours

- lectures, tutorials and examinations

Independent study: 120 hours

- independent review of course material
- work on homework assignments
- preparation for written exams

Recommendation
The following modules should have been taken: Advanced Mathematics 1

Literature
will be announced in class.

Base for
Advanced Mathematics III

M 4.4 Module: Advanced Mathematics III [M-MATH-100282]

Responsible: Prof. Dr. Roland Griesmaier
Organisation: KIT Department of Mathematics
Part of: Fundamentals of Mathematics and Natural Sciences

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-MATH-100277	Advanced Mathematics III	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100527	Tutorial Advanced Mathematics III *This item will not influence the grade calculation of this parent.*	0 CR	Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried by a written examination of length 120 minutes and by homework assignments (pre-requesite). A "pass" result on the pre-requesite is a requirement for registration for the corresponding written examination.

Prerequisites
none

Competence Goal
The students know about differential calculus for vector-valued functions of several variables and about techniques of vector calculus such as the definition and application of differential operators, the computation of domain, line and surface integrals and important integral theorems. They have basic knowledge about partial differential equations and know basic facts from stochastics.

Content
Multidimensional calculus, domain integrals, vector calculus, partial differential equations, stochastics.

Module grade calculation
The module grade is the grade of the written examination.

Workload
In class: 90 hours

- lectures, tutorials and examinations

Independent study: 120 hours

- independent review of course material
- work on homework assignments
- preparation for written exams

Recommendation
The following modules should have been taken before: Advanced Mathematics I and II

Literature
will be announced in class.

M 4.5 Module: Air Pollution Control [M-CIWVT-106448]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

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

Mandatory			
T-CIWVT-113046	Air Pollution Control	7 CR	Dittler
T-CIWVT-113047	Air Pollution Control - Project Work	5 CR	Dittler

Competence Certificate
The learning control consists of two partial achievements:

1. oral examination, duration 30 minutes
2. project work

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
Students undertstand transport behavior and methods of size distribution measurement of airborne fine particles in the context of environmental and nanotechnology. They are able to apply this knowledge to solve basic problems of particle technology in a team oriented approach.

Content
The classes provide a knowledge base of methods of particle dispersion, particle transport processes in gases, as well as methods for their characterization with applications in the environment and industrial product design. Practical experience related to these concepts is developed in a team based lab project.

Module grade calculation
The module grade is calculated from the grades of the two partial achievments:
40 % project work, 60 % oral examination.

Workload

- Attendance time: 56 h (V+Ü) + 120 (project work) + 10 (Excoursion)
- Self-Study: 24 h
- Oral examination: 140 h

Literature
Skriptum Gas-Partikel-Messtechnik

M 4.6 Module: Basic Practical Course in Natural Sciences [M-CIWVT-106427]

Responsible: Dr. Gudrun Abbt-Braun
Prof. Dr. Harald Horn
Dr. Anke Neumann

Organisation: KIT Department of Chemical and Process Engineering

Part of: Fundamentals of Mathematics and Natural Sciences

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	pass/fail	Each winter term	1 term	German	3	1

Mandatory			
T-CIWVT-113015	Laboratory Work: General Chemistry	2 CR	Abbt-Braun, Horn
T-CIWVT-113014	Laboratory Work: Microbiology for Engineers	2 CR	Neumann

Competence Certificate
The learning control consists of two partial achievements:

1. Laboratory Work: General Chemistry; ungraded coursework

2. Laboratory Work: Microbiology for Engineers; ungraded coursework

Module grade calculation
Ungraded

Annotation
Participation in the safety briefing is mandatory.

Workload
General Chemistry:
Attendance time: 5 experiments/ 20 hrs
Self-study: 40 hrs

Microbiology:
Attendance time: one week/ 40 hrs
Self-study: 20 hrs

Literature

- BAST: Mikrobiologische Methoden Steinbüchel/Oppermann-Sanio: Mikrobiologisches Praktikum
- Schweda, E.: Jander/Blasius - Anorganische Chemie I+II. Hirzel Verlag, Suttgart, 19. bzw. 18. Auflage, 2022
- Praktikumsskript Coursework "Allgemeine Chemie," provided in ILIAS.

M 4.7 Module: Biology for Engineers (BIW-TEBI-01) [M-CIWVT-106414]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Mathematics and Natural Sciences

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
9	Grade to a tenth	Each winter term	2 terms	German	3	1

Mandatory			
T-CIWVT-111063	Genetics	2 CR	Neumann
T-CIWVT-112997	Biochemistry	2,5 CR	Holtmann
T-CIWVT-113037	Cell Biology	2 CR	Gottwald
T-CIWVT-113038	Microbiology	2,5 CR	Neumann

Competence Certificate
The module is successfully completed by

- a written exam "Cell Biology" of 90 min
- a written exam "Genetics" of 90 min
- a written exam "Biochemistry" of 90 min
- a written exam "Microbiology" of 90 min

Prerequisites
None

Competence Goal
Cell-biology: Identification of pro- and eukaroytic cells, identification of pro- and eukaroytic cellular constituents, knowledge of basic metabolic pathways, knowledge of the most important molecule classes und their occurence, ability to operate a light microscope and knowledge of the underlying theory, being able to select bioreactors according to the application.

Genetics: Students are able to give a detailed description of basic aspects of molecular genetics in pro- and eukaryotes and can explain genetic processes in their own words. Basic aspects are in particular: Structure and organization of nucleic acids, mechansims of replication, transcription, translation, regulation of gene expression, recombination, transposition, DNA repair mechanisms and genetic basics of virology. Furthermore, students are able to apply their basic knowledge by explaining graphics or by transfering their knowlegde to gene technological methods.

Biochemistry: Students will be able to describe the different groups of biomolecules. In addition to the importance of water for cell metabolism and the basics of bioenergetics, they can explain the structure of carbohydrates, lipids, amino acids, peptides, proteins and nucleic acids and their importance for the living cell. You will be able to describe in detail anabolism and catabolism in primary metabolism including the basic regulatory principles. They can interpret the sequences of biochemical processes also from an energetic point of view. They can explain photosynthesis. You will be able to clarify the basic processes of protein biosynthesis.

Microbiology: Students will be able to describe the subfields of microbiology. They can explain the structure and morphology of prokaryotic and eukaryotic microorganisms and their classification in the phylogenetic system. They can describe microbial primary metabolism and explain the differences between aerobic and anaerobic respiration and fermentation processes. They will be able to clarify lithotrophy and the utilization of inorganic electron donors. They can explain the role of microorganisms in the environment and global material cycles. They can interpret the sequences of microbial processes in biotechnology.

Content
Cell biology: Microscopy; Cell structure of pro- and eukaryotes; Eukaryotic cell compartiments; Structure and function of macromolecules; Communication between cells; Cell cycle.

Genetics: Nucleic acids; Chromatin and chromosomes; Genes and genomes; Replication; Transcription; Translation; Recombination; Mutations and DNA repair mechanisms; Gene regulation; Methods and applications of molecular gene technology.

Biochemistry: structure and function of biomolecules; Introduction to primary metabolism; Bioenergetics & regulatory principles; Amino acids and peptides; Protein structure and function; Enzymes, Coenzymes and vitamins; Carbohydrates; Glycolysis and Gluconeogenesis; Citrate cycle and respiratory chain; Photosynthesis; Lipids and membranes; Protein metabolism

Microbiology: History and sub-fields of microbiology; morphology and structure of prokaryotes and eukaryotes ; Microbiological methods; Classification and structure of phylogenetic system; Growth of unicellular microorganisms; Fundamentals of microbial primary metabolism; Anaerobic respiration processes and microbial fermentations; Lithotrophy & utilization of inorganic electron donors; Microbial metabolism; Microbial evolution; Microbial ecology and global material cycles; Fundamentals of microbial biotechnology and environmental microbiology

Module grade calculation
The module grade is calculated from the LP-weighted average of the four parts of the module.

Workload
Attendance time:

- Winter Semester Lecture of 4 SWS: 60 hrs
- Summer Semester lecture of 4 SWS: 60 hrs

Homework

- Self-study time: 70 hrs
- Exam preparation: 80 h (each part about 20 hrs)

Recommendation
None

Literature
Zellbiologie:

- Alberts: Lehrbuch Molekulare Zellbiologie (Wiley-VCH)
- Munk: Biochemie - Zellbiologie (Thieme)
- Plattner/Hentschel: Zellbiologie (Thieme)

Genetik:

- Munk: Taschenlehrbuch Biologie, Genetik (Thieme)
- Knippers: Genetik (Thieme)

Biochemie:

- Voet/Voet/Pratt: Lehrbuch der Biochemie (Wiley-VCH)
- Koolman/Röhm: Taschenatlas der Biochemie (Thieme)
- Stryer: Biochemie (SpringerSpektrum)

Mikrobiologie:

- Munk: Taschenlehrbuch Mikrobiologie (Thieme)
- Cypionka: Grundlagen der Mikrobiologie (Springer)

M 4.8 Module: Biopharmaceutical Process Engineering (BIW-MAB-02) [M-CIWVT-106437]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Bioprocess Engineering)

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

Mandatory			
T-CIWVT-113023	Biopharmaceutical Process Engineering	6 CR	Hubbuch
T-CIWVT-113024	Laboratory Work: Downstream Processing	3 CR	Hubbuch

Competence Certificate
Learning control constist of

- written examination of 120 min duration
- Lab work

Prerequisites
None

Competence Goal
Overview on unit operations for protein separations and respective analytics used in the biotechnological industry.

Content
The elcture series adresses fundamentals in biotechnological purification of bio-products and respective analytics.

Lab:

Methods for the purification of proteins, which are based on solubility of proteins as well as on interactions between proteins and carrier materials. Sampling and sample preparation; protein characterisation; analytical methods for the determination of product concentrations; determination and calculation of the various process parameters; graphical representation and interpretation of the results; linearisation procedures; computer-aided process modelling and optimisation.

Module grade calculation
ECTS-weighet mean of written examination and lab work.

Workload
Lectures and exercises: 60 h
Homework: 80 h
preparation of examination: 40 h

Lab Work (one week):

Attendance time: 40 h
preparation and reports: 50 h

Literature
will be announced

M 4.9 Module: Biopharmaceutical Process Engineering (BIW-MAB-02) [M-CIWVT-106475]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

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

Mandatory			
T-CIWVT-113023	Biopharmaceutical Process Engineering	6 CR	Hubbuch

Competence Certificate
Learning controlis a written examination of 120 min duration.

Prerequisites
None

Competence Goal
Overview on unit operations for protein separations and respective analytics used in the biotechnological industry.

Content
The elcture series adresses fundamentals in biotechnological purification of bio-products and respective analytics.

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

Workload

- Lectures and exercises: 60 hrs
- Homework: 80 hrs
- preparation of examination: 40 hrs

Literature
will be announced

M 4.10 Module: Bioprocess Engineering [M-CIWVT-106434]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Process Engineering (mandatory)

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

Mandatory			
T-CIWVT-113019	Bioprocess Engineering	5 CR	Grünberger, Hubbuch

Competence Certificate
Learning control is a written exam lasting approx. 120 minutes.

Prerequisites
None

Competence Goal
The students are able to apply basic operations and concepts of process engineering to bioprocesses. They can transfer reaction engineering approaches to microbial metabolism and use them to understand real processes. They know different processes, bioreactors and process control strategies in theory and learn how to calculate and evaluate real processes from a theoretical and application perspective. They will learn to interpret, discuss and critically assess various bioprocesses in detail. Students can analyze, structure and formally describe problems in the area of biotechnological separation processes. The students are able to critically assess the different procedures.

Content
Bioprocess engineering encompasses the design, operation, control, and optimization of biochemical processes involving various biological pathways or reactions mediated by living cells of animals, plants and microorganisms or enzymes under controlled conditions for the efficient biotransformation of raw material into a range of products at requisite scales. Bioprocesses have been developed for production of wide variety of commercial products ranging from cheap to expensive specialty chemicals as antibiotics, therapeutic proteins and vaccines. Bioprocess engineering is thus the backbone of the biotechnology industry that translates the research and development to the industries and mainly consists of three fields: (i) Upstream processing (ii) Bioreactor and bioreactions (iii) downstream processing.

The course will link with basic engineering and biotechnological knowledge gained in the first years of studies. Knowledge of previous courses will be reinforced and applied for the technical development of bioprocesses. The objective of this course is to provide the students with the necessary and fundamental insight of bioprocess engineering. This includes fundamentals in biocatalysis (mainly cells as biocatalysts), microbial kinetics, mass and energy balance in bioprocesses and kinetics of bioprocesses and fermentation. Here focus will be laid on fundamental kinetic and stoichiometric principles of microbial metabolism. Based on that design and evaluation of cultivation media will be discussed. In the second part bioreactor engineering design, operation and optimization principles of fermentation processes for the production of high value bio-products will be discussed. Topics include fundamentals of process control strategies such as batch, fed-batch and continues cultivations. Construction operation, function of different types of bioprocesses will be demonstrated. Advantages and disadvantages will be discussed. First insights into bioprocess analytics and control will be given. Finally, an outlook into emerging topics within bioprocess engineering is given, including topics such as automatization and digitalization of bioprocesses and economic and sustainability considerations of bioprocesses. Furthermore, introduction into fundamentals of downstream processing will be given, including cell disruption, solid-liquid separation, partitioning, adsorption and chromatography. The students will learn to think interdisciplinary and to apply the key principles of the different bioprocess development steps. Lecture contents will be deepened by exercises.

Module grade calculation
Grade of the module is the grade of the written examination.

Workload

- Lectures: 60 h
- Homework: 50 h
- Exam Preparation: 40 h

Literature

- Horst Chmiel, Bioprozesstechnik, 2011, DOI:10.1007/978-3-8274-2477-8
- Wilfried Storhas, Bioverfahrensentwicklung, 2013, ISBN: 978-3-527-32899-4
- Clemens Posten, Integrated Bioprocess Engineering, 2018, DOI:10.1515/9783110315394

M 4.11 Module: Biotechnology (CIW-MAB-05) [M-CIWVT-101143]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each winter term	2 terms	German	4	3

Mandatory			
T-CIWVT-103669	Biotechnology	9 CR	Perner-Nochta
T-CIWVT-113097	Biotechnology - Seminar	3 CR	Perner-Nochta

Competence Certificate
The learning control consists of two partial achievements:

1. Seminar (presentation, hand-out)
2. practical work

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
Basic understanding of processes and process syntheses in biotechnological production

proseminar „Biotechnology:
After successful completion of the seminar, the students are familiar with different fields of research in biotechnology and have gained initial experience in presenting and writing texts.

Lecture „Management of scientific projects“ and exercises:
The students are able to conduct literature research on their own, design own experiments, evaluate their own data, write own scientific texts. They can plan their own small project regarding time and finances required and prepare a project plan as well as present it. They are enabled to prepare a scientific poster and present it.

Hands-on training:
The students are able to do own scientific research and practical work in the field of biotechnology. They know how to analyse their own gained data and prepare a project report.

Content
Proseminar Biotechnology:
In this proseminar, texts such as publications and book articles from various application areas and research fields of biotechnology are discussed in depth. Texts on methods and their areas of application can also be used. Through careful reading, appropriate presentation (introduction, explanation, classification) as well as extensive discussion, the students should introduce each other to relevant areas of biotechnology.

Lecture „Management of scientific projects“ and exercises:
The lecture covers literature research, design of experiments, data evaluation, scientific writing and project management; in parts it is software-based and carried out in an electronic classroom.

Practical exercises cover literature research, preparation of a project plan, presentation of the project plan, preparation of a poster, presentation of the poster

Hands-on training:
Accomplishment of autonomous investigation and practical work in the field of biotechnology, preparation of a project report

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Proseminar Biotechnology (3 ECTS):

- Attendance time: 45 hrs
- Compulsory attendance for more than 80% of the lectures
- Preparation and wrap-up seminar: 15 hrs
- Self-study: 30 hrs

Management of scientific projects:

- Lectures and Exercises: 30 hrs
- Preparation and wrap-up lectures: 30 hrs
- Self-study: 30 hrs

Lab work:

- Lab: 80 h
- Preparation and wrap-up: 10 hrs

Project work:

- Lab: 10 h
- Preparation and wrap-up: 80 hrs

Literature
Will be announced.

M 4.12 Module: Chemical Process Engineering (CIW-CVT-01) [M-CIWVT-101133]

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Process Engineering (Unit Operations)

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

Mandatory			
T-CIWVT-101884	Chemical Process Engineering	6 CR	Wehinger

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

Competence Goal
Students can analyse and design reactors for chemical and enzymatic-biochemical conversions in homogeneous phase. They are able to promote the formation of a certain desired product in multi-step reactions, when parallel and consecutive steps can yield further products. Furthermore, students can apply balances of energy to identify conditions of safe reactor operation when exo- and endothermic reactions are run.

Content
Application of mass and energy balances for the analysis and design of ideal reactors for single-phase conversions, and for the identification of optimum operation conditions.

Module grade calculation
grade of the written examination

Workload

- Attendance time: lectures and exercises: 60 h
- self-study: 60 h
- preparation of examination. 60 h

Recommendation
Courses of 1st - 4th semester

Literature

- Skript Chemische Verfahrenstechnik I, https://ilias.studium.kit.edu
- G.W. Roberts: Chemical Reactions and Chemical Reactors, Wiley VCH 2009
- O. Levenspiel: Chemical Reaction Engineering, John Wiley & Sons Inc. 1998

M 4.13 Module: Circular Economy [M-CIWVT-105995]

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

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

Mandatory			
T-CIWVT-112172	Circular Economy - Oral Exam	8 CR	Stapf
T-CIWVT-112173	Circular Economy - Project Work	4 CR	Stapf

Competence Certificate
The learning control consists of two partial achievements:

1. Oral exam on lectures, exercises and case studies, duration approx. 30 minutes.
2. Project work, exmaination of another type. The term paper and the presentation of the results are graded.

Prerequisites
Participation in the Specialization/ Project Work is only possible if the following achievements have been made:

- At least 60 credits
- At least one lab

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students understand important material systems and essential process steps of the provision and recycling of mineral and metallic raw materials and anthropogenic carbon. With the aim of closing cycles, they can use methods of process evaluation, such as analysis and assessment of process chains using efficiency indicators. To do this, students work on increasingly complex case studies in a team using scientific methods and finally apply these methods during project work.

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

- Material flow and process knowledge of the primary and the recycling industries
- Methodological knowledge (business management basics of relevance, material flow analysis, determination of performance indicators)
- Independent scientific work (application of knowledge, analysis, assessment) in case studies / as project work.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Attendance time:

- Lectures and exercises: 45 h
- Project work: 80

Self-study:

- Wrap up lectures: 45 h
- Wrap up case studies: 60 h
- Preparation term paper and presentation: 40 h

Exam preparation: 90 h

M 4.14 Module: Control Engineering and System Dynamics [M-CIWVT-106308]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-112787	Control Engineering and System Dynamics	5 CR	Meurer

Competence Certificate
Learning control is a written exam, duration120 minutes.

Prerequisites
None

Competence Goal
Provision of linear system theory and simple controls for technical systems to CIW and BIW engineers.

Content
Dynamic systems, Properties of important systems and modeling, Stability, Controller design, Estimation

Module grade calculation
The module grade is the grade of the written exam.

Workload
Attendance Time:

- Lectures:30 hrs.
- Exercises 15 hrs.

Self-study:

- Preparation and wrap-up lectures sample course: 60 hrs.
- Exam preparation: 45 hrs.

Literature

- Meurer: Regelungstechnik und Systemdynamik, Vorlesungsskript.
- Aström, R. Murray: Feedback Systems, Princeton University Press, 2008.
- C.T. Chen: Linear System Theory and Design, Oxford Univ. Press, 1999.
- Lunze: Regelungstechnik I, Springer-Verlag, 2010.
- Lunze: Regelungstechnik II, Springer-Verlag, 2010.
- H. Unbehauen: Regelungstechnik I, Vieweg, 2005.

M 4.15 Module: Data Analysis [M-CIWVT-106432]

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Mathematics and Natural Sciences

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

Mandatory			
T-CIWVT-113039	Data Analysis	3 CR	Guthausen

M 4.16 Module: Design of Machines [M-CIWVT-101941]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-103641	Design of Machines	0 CR	Gleiß
T-CIWVT-103642	Design of Machines, Exam	7 CR	Gleiß

Competence Certificate
The learning contol consists of two partial achievements.

1. Completed coursework (ungraded)/ prerequisite. 4 of 5 exercises hase to be passed.
2. Written examination lasting 120 minutes.

Prerequisites
None

Content
Scientific drawing, introduction into material science with a focus on manufacturing an design of steel, design of machines and apparatuses, hygenic design

Module grade calculation
The module grade is the grade of the written exam.

Workload
Attendance time: lecture 2 SWH, exercises 3 SWH: 70 hrs
Self-study: 70 hrs
Preparation of exam: 70 hrs

Recommendation
Moduls of the 1st semester.

M 4.17 Module: Electrochemical Energy Technologies [M-ETIT-105690]

Responsible: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 4/1/2024)

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

Mandatory			
T-ETIT-111352	Electrochemical Energy Technologies	5 CR	Krewer

Competence Certificate
Type of Examination: Written exam
Duration of Examination: 120 minutes

Prerequisites
none

Competence Goal
Students have well-grounded knowledge of electrochemical energy technologies for conversion and storage of electrical energy. They know the working principle of fuel cells, batteries and electrolysers and their components. They understand the underlying electrochemical, electrical and physical processes, and the resulting loss processes as function of operation and cell design. Participation in the course puts them in a position to build cells and evaluate and understand their performance and operating behavior. Furthermore, they can select the appropriate electrochemical cell for a given application, analyse, interpret and operate it.

Content
Lecture:

- Application and operating principle of fuel cells, batteries and elec-trolysers
- Thermodynamics, potential and voltage of electrochemical cells
- Kinetics and electrochemical reactions
- Transport processes in electrochemical cells
- Composition and types of fuel cells and electrolysers
- Composition and types of batteries
- Operation and characterization of electrochemical cells
- Electrochemical systems

Exercise:

- Application of the theory to batteries and fuel cells including example calculations.

Module grade calculation
The module grade is the grade of the written exam.

Workload

1. Attendance in lectures: 30 * 45 Min. = 22,5 h
2. Attendance in excercises: 15 * 45 Min. = 11,25 h
3. Preparation/follow-upder Vorlesungen und Übungen: 76,25 h (approx. 1,75 h per lecture/exercise)
4. Preparation of and attendance in examination: 40 h

In total: 150 h = 5 LP

M 4.18 Module: Energy and Environmental Engineering (CIW-MVM-06) [M-CIWVT-101145]

Responsible: Prof. Dr. Reinhard Rauch
Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

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

Mandatory			
T-CIWVT-103527	Energy and Environmental Engineering Project Work	4 CR	Rauch, Trimis
T-CIWVT-108254	Energy and Environmental Engineering	8 CR	Rauch, Trimis

Competence Certificate
The learning control consists of two partial achievements:

- Written examination, duration 120 minutes
- Examination of another type, project work

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students will be able to discuss, analyze and compare applications in energy engineering and environmental protection (primary/secundary means, efficiency, raw materials etc.).

Content
Introduction into production of fuels (chemical energy carriers) from fossil and renewable sources and their use, prevention of formation of pollutants, removal of pollutants, review and selected examples, fundamentals and applications of high temperature energy conversion.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Attendance time: 60 h
Excoursions: 20 h
Self-Study: 90 h
Project work: 90 h
Exam preparation: 100 h

Recommendation
Courses of 1st - 4 th semester

Literature
lecture notes and specific literature indicated during lectures, additionally:
J. Warnatz, U. Maas, R.W. Dibble: Combustion, Spinger Verlag, Berlin, Heidelberg 1997
G. Schaub, T. Turek: Energy Flows, Material Cycles and Global Development, Springer Verlag, Berlin 2011
M. Crocker (Hrsg.): Thermochemical Conversion of Biomass to Liquid Fuels and Chemicals, Springer-Verlag, Berlin 2010
E. Rebhan (Hrsg.): Energiehandbuch – Gewinnung, Wandlung und Nutzung von Energie, Springer-Verlag, Berlin 2002
B. Elvers (Hrsg.): Handbook of Fuels, Wiley-VCH, Weinheim 2008

M 4.19 Module: Energy Process Engineering (CIW-CEB-02) [M-CIWVT-101136]

Responsible: Prof. Dr.-Ing. Thomas Kolb
Prof. Dr. Oliver Thomas Stein
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

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

Mandatory			
T-CIWVT-101889	Energy Process Engineering	5 CR	Kolb, Stein

Competence Certificate
Learning control is a written examination lasting 150 min.

Prerequisites
None.

Competence Goal
Students learn to classify energy and the different appearances of energy,knowledge of the different energy sources and the national and global energy demand,knowledge and solution of simple tasks in energy conversion with different conversion methods

Content
Basics: Concepts, forms of appearance of energy, systems and balances

Process Engineering: Energy carriers, energy conversion, energy transportation and storage, decentral energy systems

Ecology / Economy / Policy

Module grade calculation
Grade of the written examination

Workload
lectures: 56 h

self-study: 50 h

preparation of examination: 44 h

Recommendation
Thermodynamik

Literature

- In der Vorlesung angegebene Litaratur, zusätzlich:
- P. Stephan, K. Schaber, K. Stephan, F. Mayinger: Thermodynamik, Springer Verlag, Berlin 2006
- J. Warnatz, U. Maas, R.W. Dibble: Combustion, Spinger Verlag, Berlin, Heidelberg 1997
- G. Schaub, T. Turek: Energy Flows, Material Cycles and Global Development, Springer Verlag, Berlin 2011
- VDI-Gesellschaft Energietechnik (Hrsg.): Energietechnische Arbeitsmappe, Springer-Verlag , Berlin 2000
- M. Crocker (Hrsg.): Thermochemical Conversion of Biomass to Liquid Fuels and Chemicals, Springer-Verlag, Berlin 2010
- E. Rebhan (Hrsg.): Energiehandbuch – Gewinnung, Wandlung und Nutzung von Energie, Springer-Verlag, Berlin 2002
- B. Elvers (Hrsg.): Handbook of Fuels, Wiley-VCH, Weinheim 2008

M 4.20 Module: Engineering Mechanics: Dynamics (CIW-MVMA-03) [M-CIWVT-101128]

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-CIWVT-101877	Engineering Mechanics: Dynamics, Exam	5 CR	Klahn
T-CIWVT-106290	Engineering Mechanics: Dynamics	0 CR	Klahn

Competence Certificate
The learning control consists of two partial achievements

1. Completed coursework/ prerequisite
2. a written examination lasting 120 minutes

Prerequisites
None

Competence Goal
Students possess basic knowledge in Engineering Mechanics/Dynamics, they are familiar with problem solving and able to use this knowledge for theoretical analysis and solution of practical engineering problems.

Content
Kinematics and dynamics of mass point;
Kinematics and dynamics of rigid body;
The principle of linear momentum, angular momentum, work and energy theorem;
Oscillation of the systems with one or more freedom degrees;
Relative movement of mass point;
Methods in analytical Mechanics, Lagrange equation;

Module grade calculation
grade of the written examination. Superior preliminary test can be credited according to §7,13 SPO.

Workload
lectures and exercises: 56 h
self study: 56 h
preparation for examination 40h

Recommendation
modules of 1. -2. semester.

Literature

- Gross/Ehlers/Wriggers/Schröder/Mülle: Formeln und Aufgaben zur Technischen Mechanik 3, 13. Auflage https://doi.org/10.1007/978-3-662-66190-1
- Kühlhorn/Silber: Technische Mechanik für Ingenieure, Hüthig 2000
- Hibbler: Dynamik,Pearson 2006, 10. Auflage
- Wriggers/Nackenhorst/Beuermann/Spiess/Löhnert: Technische Mechanik kompakt, Teubner2006

M 4.21 Module: Engineering Mechanics: Statics [M-CIWVT-105846]

Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-111054	Engineering Mechanics: Statics	5 CR	Hochstein, Willenbacher

M 4.22 Module: Fluiddynamics (CIW-MVMV-03) [M-CIWVT-101131]

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-101882	Fluiddynamics, Exam	5 CR	Nirschl
T-CIWVT-101904	Fluiddynamics, Tutorial	0 CR	Nirschl

Competence Certificate
Learning control consists of:

1. written exam of 120 minutes duration according to § 4 (2) SPO.

2. Non-graded precondition for participation according to § 4 (3) SPO:
eihter 4 of 5 compulsory exercises have to be approved
or a group presentation has to be given during the lecture

Prerequisites
none

Competence Goal
The students have the ability to analyse, to structure and to describe problems in fluid dynamics. The also can use the specific methods for the calculation of specific flows with the studied tools. Besides they are able to discuss the different procedures critically.

Content
Fundamentals of fluid dynamics: hydro static, aerostatik, compressible and incompressible flows, turbulent flows, Navier-Stokes equations, boundary layer theory

Module grade calculation
grade of the written examination

Workload
lecture 2 SWH, exercises 2 SWH: 56 h
self-study: 56 h
preparation of examination: 56 h

Recommendation
Courses of 1st - 3rd semester

Literature
Nirschl, Zarzalis: Skriptum Fluidmechanik

Zierep: Grundzüge der Strömungslehre, Teubner 2008

Prandtl: Führer durch die Strömungslehre, Teubner 2008

M 4.23 Module: Food Bioprocess Engineering (BIW-LVT-02) [M-CIWVT-106476]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization 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-113021	Food Bioprocess Engineering	6 CR	Karbstein
T-CIWVT-113041	Food Bioprocess Engineering - Prerequisite	0 CR	Karbstein

Competence Certificate
The Module comprises two learning controls:

1. Prerequisite: ungrades ILIAS-Test
2. written examination, duration 120 minutes

Prerequisites
In order to participate in the written exam, the prerequisite (Ilias tests) must be passed.

Competence Goal
The students will know about basics to secure food (and life science product) safety.

Content
The students will learn about microorganisms being important for food safety and biotechnological food production. Based on some historical products student will learn modern process technology. Technologies to secure food (and life science product safety) will be teached. Using actual case studies students will learn how food process engineers work. Process and product design will be rehearsed and practised in exercises and commented students' presentations.

Module grade calculation
The module grade is the grade of the written exam.

Workload
Attendance time/ lectures and exercises:

- 50 hrs self-study using the materials provided in ILIAS.
- 40 hrs lectures and exercises: discussion of the independently prepared learning content

Selbststudium:

- 50 hrs wrap-up of lectures and exercises
- 40 hrs exam preparation

Recommendation
Independent preparation of the classroom sessions using material in the ILIAS course (videos, worksheets, sample assignments) is essential for participation.

Literature

- Lebensmittelmikrobiologie (J. Krämer, UTB Ulmer)
- Lebensmittelbiotechnologie (Heinz Rutloff, Akademie Verlag)
- Lebensmittelverfahrenstechnik, Teil A (Schuchmann, Wiley)
- Lebensmittelbiotechnologie: eine Einführung (P. Czermak, GIT)
- Lebensmittelbiotechnolige (R. Heiss, Springer)
- Lexikon der Lebensmitteltechnologie (B. Kunz, Springer)
- Taschenatlas der Biotechnologie und Gentechnik (Rolf D. Schmid, Wiley)
- Mikroorganismen in Lebensmitteln (H. Keweloh, Pfanneberg)
- Mikrobiologie der Lebensmittel (G. Müller, H. Weber, Behr's)
- Grundzüge der Lebensmitteltechnik (H.-D. Tscheuschner, Behr's)
- Vorlesungsfolien, Skripte mit Übungsfragen, Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)

M 4.24 Module: Food Bioprocess Engineering (BIW-LVT-02) [M-CIWVT-106436]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Bioprocess Engineering)

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

Mandatory			
T-CIWVT-113021	Food Bioprocess Engineering	6 CR	Karbstein
T-CIWVT-113022	Food Bioprocess Engineering Lab	3 CR	Karbstein
T-CIWVT-113041	Food Bioprocess Engineering - Prerequisite	0 CR	Karbstein

Competence Certificate
The Module comprises two learning controls:

1. written examination, duration 120 minutes

2. Lab

Prerequisites
In order to participate in the written exam and the lab course, the prerequisite (Ilias tests) must be passed.

Competence Goal
The students will know about basics to secure food (and life science product) safety.

Content
The students will learn about microorganisms being important for food safety and biotechnological food production. Based on some historical products student will learn modern process technology. Technologies to secure food (and life science product safety) will be teached. Using actual case studies students will learn how food process engineers work. Process and product design will be rehearsed and practised in exercises and commented students' presentations.

Module grade calculation
The module grade is the CP-weighted average of the two graded partial achievements.

Workload
Attendance time/ lectures and exercises:

- 50 hrs self-study using the materials provided in ILIAS.
- 40 hrs lectures and exercises: discussion of the independently prepared learning content

Selbststudium:

- 50 hrs wrap-up of lectures and exercises
- 40 hrs exam preparation

Lab-Course: One week

- 40 hrs attendance time
- 50 hrs preparation of laboratory experiments, preparation of the experimental protocols

Recommendation
Independent preparation of the classroom sessions using material in the ILIAS course (videos, worksheets, sample assignments) is essential for participation.

Literature

- Lebensmittelmikrobiologie (J. Krämer, UTB Ulmer)
- Lebensmittelbiotechnologie (Heinz Rutloff, Akademie Verlag)
- Lebensmittelverfahrenstechnik, Teil A (Schuchmann, Wiley)
- Lebensmittelbiotechnologie: eine Einführung (P. Czermak, GIT)
- Lebensmittelbiotechnolige (R. Heiss, Springer)
- Lexikon der Lebensmitteltechnologie (B. Kunz, Springer)
- Taschenatlas der Biotechnologie und Gentechnik (Rolf D. Schmid, Wiley)
- Mikroorganismen in Lebensmitteln (H. Keweloh, Pfanneberg)
- Mikrobiologie der Lebensmittel (G. Müller, H. Weber, Behr's)
- Grundzüge der Lebensmitteltechnik (H.-D. Tscheuschner, Behr's)
- Vorlesungsfolien, Skripte mit Übungsfragen, Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)

M 4.25 Module: Food Technology (CIW-LVT-03) [M-CIWVT-101148]

Responsible: Dr.-Ing. Nico Leister
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading scale	Duration	Language	Level	Version
12	Grade to a tenth	2 terms	German	4	4

Mandatory			
T-CIWVT-103528	Food Technology	5 CR	Leister
T-CIWVT-103529	Food Technology Project Work	7 CR	Leister

Competence Certificate
The learning control consists of two partial achievements:

1. Written examination, duration 60 minutes
2. Project work (presentation and report of results)

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students are able to design and evaluate simple food products. They learned to define, focus and solve tasks milestone-oriented as an interdisciplinary team. The gained in depth insight in the influence of recipe and process parameters on food quality parameters using a selected product produced on pilot scale. They will be able to present targets and results of their team project in a clear, conceptual and comprehensible manner.

Content
Lecture: Basic introduction to the design and quality assurance of selected foods;
project work (team work): definition, production and evaluation of selected products as a team; presentation and defense of the project and its results incl. degustation in a bigger group;
field trip to industrial production plants

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload

- Attendance time: 115 hrs
  (lecture 1 SWS, exercises 1 SWS, project work 5 SWS)
- self study: 185 hrs
  (project design, project meetings, research on project work, lab, preparation and wrap-up)
- exam preparation: 60 hrs

Literature
Will be offered within the lecture, depending on products available

M 4.26 Module: Fundamentals of Heat and Mass Transfer (CIW-TVT-01) [M-CIWVT-101132]

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-101883	Fundamentals of Heat and Mass Transfer	7 CR	Schabel, Wetzel

Competence Certificate
Success control is a written examination, duration 180 minutes according to § 4 Abs. 2 SPO.

Prerequisites
none

Competence Goal
Elaborating the fundamental physics and laws of heat and mass transfer and at the provision of knowledge about of the methodological tools required for solving engneering tasks in these fields.

Content
Heat Transfer: Definitions - System, balances and conservation equations, kinetics of heat transfer, heat conduction, heat radiation, heat transfer between solids and moving fluids, dimensionless numbers.

Mass Transfer: Kinetics of mass transfer, equilibrium, diffusion and mass flow, Knudsen- and multi-component diffusion, Lewis analogy of heat and mass transfer.

Module grade calculation
Grade of the written examination

Workload
lecture: 75 h

self-study: 55 h

preparation of examination: 80 h

Recommendation
Courses of 1st - 3rd semester, especially fundamentals of themodynamics.

Literature
v. Boeckh, Wetzel: Wärmeübertragung, Springer 2009

Schabel: Stoffübertragung I, Skript

M 4.27 Module: Fundamentals of Refrigeration (CIW-TTK-03) [M-CIWVT-104457]

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each winter term	2 terms	German	3	4

Mandatory			
T-CIWVT-109117	Fundamentals of Refrigeration, Oral Examination	6 CR	Grohmann
T-CIWVT-109118	Fundamentals of Refrigeration, Project Work	6 CR	Grohmann

Competence Certificate
The learning control consists of two partial achievements:

1. Project work/ presentation, examination of another type
2. Oral exam of about 30 minutes duration

The project work is a prerequisite for the oral examination.

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
Students are able to explain and apply the fundamentals of refrigeration to various refrigeration technologies. They are able to describe properties of refrigerants and working fluids, and to assess their environmental impact based in different criteria. The students can develop concepts of refrigeration and heat pump processes using phase diagrams and fluid property models, and they are able to explore the energy consumption based on first and second law analyses. They are able to design various circuit configurations, to dimension and select refrigeration compressors and heat exchangers, and to design suitable control systems.

Content
Introduction to the fundamentals of refrigeration, phase diagrams, energy transformation based on first and second law analyses, refrigerants and working fluids including their environmental impact, design of common refrigeration and heat pump processes, major circuit components and process control.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Attendance time: Lecture 2 SWS, Exercises 1 SWS: 45 h
Self-Study: 60 h
Exam Praparation: 75 h
Project work including presentation: 180 h

Recommendation
None

Literature

- Jungnickel, H., Agsten, R. und Kraus, W.E., 3. Auflage (1990), Verlag Technik GmbH, Berlin
- v. Cube, H.L. (Hrsg.), Lehrbuch der Kältetechnik Band 1 und 2, 4. Auflage (1997), C.F. Müller, Heidelberg
- Gosney, W.B., Principles of Refrigeration, Cambridge University Press, Cambridge, 1982
- Berliner, P., Kältetechnik Vogel-Verlag, Würzburg (1986 und frühere)
- Kältemaschinenregeln, Deutscher Kälte- und Klimatechnischer Verein (DKV) (Herausgeber)
- DKV-Arbeitsblätter für die Wärme- und Kältetechnik in: C.F. Müller Verlag, Hüthig Gruppe, Heidelberg, wird jeweils aktualisiert (Sept. 2008)

M 4.28 Module: Further Examinations [M-CIWVT-102017]

Organisation: KIT Department of Chemical and Process Engineering
Part of: Additional Examinations

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	pass/fail	Each term	1 term	German	3	1

Prerequisites
None

M 4.29 Module: General Chemistry and Chemistry of Aqueous Solutions [M-CIWVT-106431]

Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Mathematics and Natural Sciences

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

Mandatory			
T-CIWVT-101892	General Chemistry and Chemistry of Aqueous Solutions	6 CR	Horn

Competence Certificate
Learning control is a written exam, 150 min to lecture " General Chemistry and Chemistry of Aqueous Solutions" (lecture 3 SWS, exercises 2 SWS)

Prerequisites
None

Competence Goal
The students receive a basic knowledge of the general chemistry. They get basic knowledge about the periodic system of the elements, the chemical bonds, and the geometry of molecules. They can describe the principles and the criteria about the reactions in aqueous solutions, about acid and bases, reaction kinetics, the chemical equilibrium and electrochemistry.

Content
Basics of general, inorganic and physical chemistry.

Module grade calculation
The module grade ist the grade of the wirtten exam.

Workload

- Attendance time lecture: 60 h
- Preparation/follow-up: 60 h
- Examination + exam. preparation: 60 h

Literature

- Mortimer, Müller: Chemie, current edition, Thieme Verlag 2014
- Riedel, Meyer: Allgemeine und Anorganische Chemie, current edition, de Gruyter Verlag 2013
- Horn: Scriptum of the lectures, current edition, will be available in ILIAS

M 4.30 Module: Industrial Organic Chemistry (CIW-MAB-03) [M-CIWVT-101137]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

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

Mandatory			
T-CIWVT-101890	Industrial Organic Chemistry	5 CR	Rauch

Competence Certificate
Learning control is a written examination of 120 min duration according to § 4 Abs. 2 SPO.

Prerequisites
Organic Chemistry

Competence Goal
Consolidate knowledge of organic materials and types of chemical reactions; understand logic relations between types of chemical reaction and technical processes, for selected examples; understand industrial material conversion pathways from raw materials to final products.

Content
Feedstock's for industrial processes of organic chemistry, industrial production of basic chemicals and intermediates using practical examples, digitalization and industry 4.0 in the chemical industry.

Mechanism during formation of synthetic macromolecules, production and properties of plastics and polymers, spectroscopic methods of analyzing organic molecules.

Module grade calculation
grade of the written examination

Workload
lecture: 60 h
self-study: 40 h
preparation of examination: 50 h

Literature
Handouts
Onken, Behr: Chem. Prozeßkunde, Wiley-VCH 1996
Arpe: Industrielle Org. Chemie, Wiley-VCH 2007
Brahm: Polymerchemie kompakt, Hirzel 2009
Tieke: Makromolekulare Chemie, Wiley-VCH 2014
Hesse u.a.: Spektroskop. Methoden in der OC, Thieme 2011

M 4.31 Module: Intensification of Bioprocesses [M-CIWVT-106444]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

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

Mandatory			
T-CIWVT-112998	Intensification of Bioprocesses - Written Exam	6 CR	Holtmann

Competence Certificate
The learing controlis a written examination, duration: 90 minutes.

Prerequisites
None

Competence Goal
Technical and methodological competencies

Students will be able to:

- explain the concepts of process intensification
- describe different intensified processes quantitatively
- design and evaluate bioprocess engineering processes on the basis of PI
- analyse interdisciplinary problems at the interface of technology and biological systems and develop solutions to problems
- develop processes with optimal productivities using as little energy and raw materials as possible by combining the advantages of individual disciplines

Social and personal competence

The students will be able to:

- analyse the framework conditions for innovative processes and identify the essential aspects
- identify and evaluate (interdisciplinary) process options
- become independently familiar with new topics
- summarize complex scientific processes

Content
Companies in the chemical and biotechnology industries face particular challenges in times of rising raw material costs, increased competition, and shorter product life cycles.

Process-intensified operations offer great potential for resource efficiency by helping to save materials and energy. According to a generally accepted definition, "Process Intensification (PI) is a collection of revolutionary innovative principles (paradigm shifts) for equipment and processes that can lead to significant improvements in process or process chain efficiency, investment and operating costs, quality, waste, process safety (and other aspects)".

In recent years, process intensification methods have been increasingly used in bioprocess engineering (USP and DSP). These methods are the focus of this module. The following topics are covered in the module:

- Definition of PI, distinction between process optimization and PI.
- Examples from chemical engineering
- Intensified bioreactors and reactor selection (e.g., single-use technologies, rotating bed reactors, enzyme membrane reactors, biofilm reactors)
- PI through adapted operating modes (e.g., repeated fed-batch, perfusion, continuous processes, in situ product removal)
- Process intensification through immobilized enzymes and microorganisms
- Integration of chemo- and biocatalysis
- Electro biotechnological processes
- Photo biotechnological processes
- Use of ultrasound and microwaves for bioprocess intensification
- Bioprocesses in alternative reaction media
- Use of extremophilic organisms / unconventional production organisms

In all sub-areas, the focus is on the quantitative description of the intensified processes.

Module grade calculation
The module grade is the grade of the written exam.

Workload

- Attendance time: 60 hrs lectures and exercieses
- Preparation and wrap-up lectures: 80 hrs
- Exam preparation: 40 hrs

Recommendation
Fundamentals in bioprocess engineering are required.

Literature

- Frerich J. Keil (2017) Process intensification, doi.org/10.1515/revce-2017-0085
- Andrzej Stankiewicz, Tom van Gerven, Georgios Stefanidis (2019) The Fundamentals of Process Intensification, Wiley-VCH, Weinheim, ISBN: 978-3-527-32783-6
- VDI ZRE Publikationen: Kurzanalyse Nr. 24, Ressourceneffizienz durch Prozessintensivierung
- Burek et al (2022) Process Intensification as Game Changer in Enzyme Catalysis, https://doi.org/10.3389/fctls.2022.858706

Further literature recommendations will be announced.

M 4.32 Module: Intensification of Bioprocesses [M-CIWVT-106416]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Bioprocess Engineering)

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

Mandatory			
T-CIWVT-112998	Intensification of Bioprocesses - Written Exam	6 CR	Holtmann
T-CIWVT-112999	Intensivication of Bioprocesses - Lab	3 CR	Holtmann, Neumann

Competence Certificate
The learing control consists of two partial achievements:

- Written examination, duration: 90 minutes
- Laboratory work: Examination of anaother type

Prerequisites
None

Competence Goal
Technical and methodological competencies

Students will be able to:

- explain the concepts of process intensification
- describe different intensified processes quantitatively
- design and evaluate bioprocess engineering processes on the basis of PI
- analyse interdisciplinary problems at the interface of technology and biological systems and develop solutions to problems
- develop processes with optimal productivities using as little energy and raw materials as possible by combining the advantages of individual disciplines

Social and personal competence

The students will be able to:

- analyse the framework conditions for innovative processes and identify the essential aspects
- identify and evaluate (interdisciplinary) process options
- become independently familiar with new topics
- summarize complex scientific processes

Content
Companies in the chemical and biotechnology industries face particular challenges in times of rising raw material costs, increased competition, and shorter product life cycles.

Process-intensified operations offer great potential for resource efficiency by helping to save materials and energy. According to a generally accepted definition, "Process Intensification (PI) is a collection of revolutionary innovative principles (paradigm shifts) for equipment and processes that can lead to significant improvements in process or process chain efficiency, investment and operating costs, quality, waste, process safety (and other aspects)".

In recent years, process intensification methods have been increasingly used in bioprocess engineering (USP and DSP). These methods are the focus of this module. The following topics are covered in the module:

- Definition of PI, distinction between process optimization and PI.
- Examples from chemical engineering
- Intensified bioreactors and reactor selection (e.g., single-use technologies, rotating bed reactors, enzyme membrane reactors, biofilm reactors)
- PI through adapted operating modes (e.g., repeated fed-batch, perfusion, continuous processes, in situ product removal)
- Process intensification through immobilized enzymes and microorganisms
- Integration of chemo- and biocatalysis
- Electro biotechnological processes
- Photo biotechnological processes
- Use of ultrasound and microwaves for bioprocess intensification
- Bioprocesses in alternative reaction media
- Use of extremophilic organisms / unconventional production organisms

In all sub-areas, the focus is on the quantitative description of the intensified processes.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Lectures and exercises:

- Attendance time: 60 hrs
- Preparation and wrap-up lectures: 80 hrs
- Exam preparation: 40 hrs

Lab course (90 hrs in total)

- Preparation
- Experiments
- Experimental protocols

Recommendation
Fundamentals in bioprocess engineering are required.

Literature

- Frerich J. Keil (2017) Process intensification, doi.org/10.1515/revce-2017-0085
- Andrzej Stankiewicz, Tom van Gerven, Georgios Stefanidis (2019) The Fundamentals of Process Intensification, Wiley-VCH, Weinheim, ISBN: 978-3-527-32783-6
- VDI ZRE Publikationen: Kurzanalyse Nr. 24, Ressourceneffizienz durch Prozessintensivierung
- Burek et al (2022) Process Intensification as Game Changer in Enzyme Catalysis, https://doi.org/10.3389/fctls.2022.858706

Further literature recommendations will be announced.

M 4.33 Module: Introduction into Bioengineering [M-CIWVT-106433]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Prof. Dr.-Ing. Dirk Holtmann
Prof. Dr. Jürgen Hubbuch
Dr.-Ing. Ulrike van der Schaaf

Organisation: KIT Department of Chemical and Process Engineering

Part of: Fundamentals of Process Engineering (mandatory)

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

Mandatory			
T-CIWVT-113018	Introduction into Bioengineering	5 CR	Grünberger, Holtmann, Hubbuch, Karbstein

M 4.34 Module: Mathematical Modeling for Biochemical Engineering [M-MATH-106443]

Responsible: PD Dr. Gudrun Thäter
Organisation: KIT Department of Mathematics
Part of: Fundamentals of Mathematics and Natural Sciences

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

Mandatory			
T-MATH-113040	Mathematical Modeling for Biochemical Engineering	4 CR	Thäter

M 4.35 Module: Mechanical Processing (CIW-MVMG-01) [M-CIWVT-101135]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Process Engineering (Unit Operations)

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

Mandatory			
T-CIWVT-101886	Mechanical Processing	6 CR	Dittler

Competence Certificate
The learning control is a written examination lasting 120 minutes.

Prerequisites
None

Competence Goal
Students have a basic understanding of properties & behavior of particulate systems in important engineering applications; they are able to use this understanding for calculations and design of selected processes.

Content

- Unit operations of mechanical processing - introduction and overview
- Particle size distribution - determination, depiction, conversion
- Forces on particles in flows
- Separating function - characterization of a separations process
- Fundamentals of mixing and stirring
- Introduction to dimensional analysis
- Characterizations of packings
- Capillarity in porous systems
- Flow through porous systems, fluidized bed
- Fundamentals of agglomeration
- Fundamentals of storage and conveyance

Module grade calculation
The module grade is the grade of the written exam.

Workload

- Attendance time: Lectures and exercises: 60 hrs
- Self-study: 45 hrs (about three hours per week)
- Preparation of examination: 75 hrs

Recommendation
Courses of 1st - 4th semester

Literature

- Dittler, Skriptum MVT
- Löffler, Raasch: Grundlagen der Mechanischen Verfahrenstechnik, Vieweg 1992
- Schubert, Heidenreich, Liepe, Neeße: Mechanische Verfahrenstechnik, Deutscher Verlag Grundstoffindustrie, Leipzig 1990
- Dialer, Onken, Leschonski: Grundzüge Verfahrenstechnik&Reaktionstechnik, Hanser Verlag 1986
- Zogg: Einführung in die Mechanische Verfahrenstechnik, Teubner 1993

M 4.36 Module: Mechanical Separation Technology (CIW-MVMV-06) [M-CIWVT-101147]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each winter term	2 terms	German	4	3

Mandatory			
T-CIWVT-103448	Mechanical Separation Technology Exam	8 CR	Gleiß
T-CIWVT-103452	Mechanical Separation Technology Project Work	4 CR	Gleiß

Competence Certificate
The learning control consists of two partial achievements:

1. An oral individual examination with a duration of about 30 minutes for the lecture "Mechanical Separation Technology" and related exercises

2. Project work. Practical collaboration, written report and oral presentation of the results are rated.

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students are able to explain 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 betwen product operation and design parameters to different separation techniques. They can analyse separation problems with scientific methods and give alternative problem solution proposals. The students are able to execute their fundamental and process knowledge practically to the example of beer brewing.

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 apppartuses and machines; apparatus combinations; case studies to solve sparation problems.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload
Lecture 3 SWS exercises 1 SWS:

- attendance time: 60h
- self-study: 80h
- examination preparation: 80h

project work

- attendance time and self-study: 140h

Literature
Anlauf: Script "Mechanische Separationstechnik - Fest/Flüssig-Trennung"

M 4.37 Module: Micro Process Engineering (CIW-IMVT-01) [M-CIWVT-101154]

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each winter term	2 terms	German	4	3

Mandatory			
T-CIWVT-103666	Micro Process Engineering	7 CR	Pfeifer
T-CIWVT-103667	Micro Process Engineering	5 CR	Pfeifer

Competence Certificate
The learning control consists of three partial achievements:

1. Oral examination of about 25 minutes duration
2. project work

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students are able 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
Basic knowledge of micro process engineering systems: fabrication of microstructured systems and interaction with processes, intensification of heat exchange and special effects by heat conduction, residence time distribution in reactors and peculiarities in microstructured systems, structured flow mixers (designs and characterization) and dimensioning of structured reactors with regard to heat and mass transfer.

Module grade calculation
The module grade is the CP-weighted average of the two partial achievements.

Workload

- Attendance time: Lectures and exercises 60 hrs
- Self-study: 60 hrs
- Exam preparation: 2 weeks/ 60 hrs
- Project work: 180 hrs

Literature
Scriptum (slides collection)

text books:

- 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 4.38 Module: Module Bachelor's Thesis [M-CIWVT-106580]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: Bachelor's Thesis

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

Mandatory			
T-CIWVT-113255	Bachelor's Thesis	12 CR	

Prerequisites
None

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in your course of studies.

M 4.39 Module: Organic Chemistry for Engineers (CIW-CHEM-04) [M-CHEMBIO-101115]

Responsible: Prof. Dr. Michael Meier
Organisation: KIT Department of Chemistry and Biosciences
Part of: Fundamentals of Mathematics and Natural Sciences

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

Mandatory			
T-CHEMBIO-101865	Organic Chemistry for Engineers	5 CR	Meier

Competence Certificate
graded: written examination

Prerequisites
none

Competence Goal
Relevance of Organic Chemistry; fundamental and method-oriented knowledge;correlation between structure and reactivity;knowledge of important concepts and principles;self-solving of problems in Organic Chemistry

Content
Nomenclature, electronic structure and bonding of organic molecules; Organic substance classes and functional groups; Reaction mechanisms and synthesis of organic compounds; Stereoisomers and optical activity; Synthetic polymers and biopolymers;Identification of organic compounds

Module grade calculation
grade of the written examination

Workload
lectures and exercises: 34h

homework and preparation of examination: 86h

Literature
Paula Y. Bruice: Organic Chemistry, 5th ed., Prentice Hall, 2007

Paula Y. Bruice: Study guide and solutions manual, 5th ed., Prentice Hall, 2007

K.P.C. Vollhardt, Neil Schore: Organic Chemistry, 5th ed., Palgrave Macmillan, 2006

K.P.C. Vollhardt, Study guide and solutions manual, 5th ed., Palgrave Macmillan, 2006

M 4.40 Module: Orientation Exam [M-CIWVT-106447]

Organisation: KIT Department of Chemical and Process Engineering
Part of: Orientation Exam

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
0	pass/fail	Each term	2 terms	German	3	2

Mandatory			
T-MATH-100275	Advanced Mathematics I	7 CR	Arens, Griesmaier, Hettlich
T-MATH-100525	Tutorial Advanced Mathematics I	0 CR	Arens, Griesmaier, Hettlich
T-CIWVT-111063	Genetics	2 CR	Neumann
T-CIWVT-113037	Cell Biology	2 CR	Gottwald

Modelled deadline
This module must be passed until the end of the **3. term**.

Prerequisites
None

M 4.41 Module: Process Development and Scale-up (CIW-IKFT-01) [M-CIWVT-101153]

Responsible: Prof. Dr.-Ing. Jörg Sauer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

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

Mandatory			
T-CIWVT-103530	Process Development and Scale-up	8 CR	Sauer
T-CIWVT-103556	Process Development and Scale-up Project Work	4 CR	Sauer
T-CIWVT-111005	Exercises Process Development and Scale-up	0 CR	Sauer

Competence Certificate
The learning control consists of three partial achievements:

- Project work/ presentation and report
- Ungraded online-tests (prerequisite for oral examination)
- Individual oral examination, duration 30 minutes

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your course of studies.

Competence Goal
The students are capable of developing energy and material balances for complex processes in process technology and to analyze processes in terms of potentials for optimization. They are able to derive suitable methods for the optimization of such processes.
The students are able to calculate the costs of major pieces of equipment and to apply estimation methods for investment costs of production plants. Together with the calculation of variable production costs they are able to analyze the profitability of a chemical process plant. Furthermore the students learn basic concepts of project management, they are enabled to work in teams and guided for intependent scientific work.

Content
Introduction into the basics of process development and project management for the development of chemical processes from the lab into production scale, including the design of a chemical process, design of miniplants and scale-up into production scale. Overview over methods for the economic, technical evaluation of processes and the preparation of business concepts.

Module grade calculation
50 % oral examination, 50 % project work.

Annotation
As part of the project study a visit to the IKFT and the bioliq plant at the Campus North is intended.

Workload
Lecture and Exercise:
Attendance time: 45 h
Self-study: 90 h
Exam preparation: 45 h

Project work: 180 h

Literature

- Vorlesungs- und Übungsfolien (KIT Studierendenportal ILIAS)
- Helmus, F. P., Process Plant Design: Project Management from Inquiry to Acceptance, Wiley-VCH, 2008.
- Towler, G., Sinnott, R. K., Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann, 2012.
- Peters, M.S., Timmerhaus, K.D., West R.E.: Plant Design and Economics for Chemical Engineers, 2003, Mc Graw-Hill, NY.
- Seider, W.D., Seader, J.D., Lewin, D. R., Widagdo, S.: Product and Process Design Principles, Wiley & Sons, NY, 2010.
- Vogel, G.H.:. Verfahrensentwicklung, Wiley-VCH, 2002.
- Belbin, R.M., Management Teams, Why They Succeed or Fail, Routledge, NY, 2013.
- Busse von Colbe, W.; Coenenberg, A.G., Kajüter, P., Linnhoff, U., Betriebswirtschaftslehre für Führungskräfte, 2002, S. 148

M 4.42 Module: Programming and Numeric Simulation [M-CIWVT-106438]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Interdisciplinary Qualifications

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	pass/fail	Each summer term	1 term	German	3	1

Mandatory			
T-CIWVT-113025	Programming and Numeric Simulation	1 CR	Meurer
T-CIWVT-113074	Programming and Numeric Simulation Using MATLAB - Ecercises	2 CR	Meurer

Prerequisites
None

Module grade calculation
Ungraded

M 4.43 Module: Scientific Writing with LaTeX [M-HOC-106502]

Organisation:

Part of: Interdisciplinary Qualifications

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
2	pass/fail	Each winter term	1 term	German	3	1

Mandatory			
T-HOC-113121	Scientific Writing with LaTeX	2 CR	Hirsch-Weber

M 4.44 Module: Single Results [M-CIWVT-101991]

Responsible: Dr.-Ing. Barbara Freudig
Organisation: KIT Department of Chemical and Process Engineering
Part of: Master's Transfer Account

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	pass/fail	Each term	1 term	German	3	3

Master Transfer Examinations (Election: at least 30 credits)			
T-CIWVT-106028	Particle Technology Exam	6 CR	Dittler
T-CIWVT-106029	Biopharmaceutical Purification Processes	6 CR	Hubbuch
T-CIWVT-106030	Biotechnological Production	6 CR	Holtmann
T-CIWVT-106032	Kinetics and Catalysis	6 CR	Wehinger
T-CIWVT-106033	Thermodynamics III	6 CR	Enders
T-CIWVT-106034	Thermal Transport Processes	6 CR	Kind, Schabel, Wetzel
T-CIWVT-106035	Computational Fluid Dynamics	6 CR	Nirschl
T-CIWVT-106036	Internship	14 CR	Bajohr, Freudig
T-CIWVT-106037	Selected Formulation Technologies	6 CR	Karbstein, Leister
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
T-CIWVT-108492	Seminar Biotechnological Production	0 CR	Holtmann
T-CHEMBIO-109178	Physical Chemistry (Written Exam)	4 CR	Kubar, Meier
T-CHEMBIO-109179	Physical Chemistry (Lab)	2 CR	Kubar, Meier
T-CIWVT-112766	Bioprocess Development	6 CR	Grünberger
T-CIWVT-113235	Excercises: Membrane Technologies	1 CR	Horn, Saravia
T-CIWVT-113236	Membrane Technologies in Water Treatment	5 CR	Horn, Saravia

Prerequisites
None

M 4.45 Module: Supplementary Studies on Culture and Society [M-ZAK-106235]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: Additional Examinations

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 examantion 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 1Technology & Responsibility

Value change / ethics of responsibility, technology development / history of technology, general ecology, sustainability

Block 2Doing Culture

Cultural studies, cultural management, creative industries, cultural institutions, cultural policy

Block 3Media & Aesthetics

Media communication, cultural aesthetics

Block 4Spheres of Life

Cultural sociology, cultural heritage, architecture and urban planning, industrial science

Block 5Global 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 4.46 Module: Supplementary Studies on Sustainable Development [M-ZAK-106099]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:

Part of: Additional Examinations

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 examantion 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 4.47 Module: Thermal Process Engineering (CIW-TVT-02) [M-CIWVT-101134]

Responsible: Dr.-Ing. Benjamin Dietrich
Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Process Engineering (Unit Operations)

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

Mandatory			
T-CIWVT-101885	Thermal Process Engineering	6 CR	Kind

Competence Certificate
Sucess control is a written examination taking 120 minutes in time according to § 4 Abs. 2 SPO.
From winter term 21/22: 180 minutes.

Prerequisites
None

Competence Goal
Students can explain fundamental knowledge in the field of Thermal Separations. Emphasis is laid on the difference between methodological tools and their application for the description of selected unit operations. They can work on standard types of problems in the field of Thermal Process Engineering. They can solve it mathematically and can apply methologocal tools adequate. Furthermore, the students can quantitatively apply these tools and skills to processes and problems which are new to them.

Content
The tought methodological tools are balancing of conservative quantities, thermodynamic equilibrium and their application to single- and multi-stage processes. Within this module the following unit operations are introduced: Distillation, Rectification, Absorption, Extraction, Evaporation, Crystallisation, Drying, Adsorption/Chromatography.

Module grade calculation
The mark of the module is equal to the mark of the written examination.

Workload
Attendence time (lecture and tutorials): 56 h
Self study: 44 h
Examination preparation: 80 h

Recommendation
Courses of 1st - 4th semester

Literature
personal prints, scientific text books

M 4.48 Module: Thermodynamics I (CIW-TTK-01) [M-CIWVT-101129]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
7	Grade to a tenth	Each winter term	1 term	German	3	2

Mandatory			
T-CIWVT-101878	Thermodynamics I, Tutorial	0 CR	Enders
T-CIWVT-101879	Thermodynamics I, Exam	7 CR	Enders

Competence Certificate
The learning control consists of two partial achievements:

1. Written examination lasting 120 min
2. Prerequisite for participation: Completed coursework;
   2 of 3 compulsory exercises have to be approved

Prerequisites
Before taking the written exam, the compleded coursework must be passed.

Competence Goal
Students are able to analyse and to design energy conversion processes by applying the first and second law of thermodynamics. They understand the behaviour of real pure substances, and they are able to explain thermodynamic processes with and without phase change by means of state diagrams and process schemes.

Content
Fundamental terms; thermodynamic equilibrium and temperature; properties and equation of state for ideal gases; energy and first law for closed systems; balances for open systems; entropy and thermodynamic potentials; second law; equations of state for pure component caloric properties; phase change behavior of pure component systems and state diagrams; thermodynamic cycles for power generation, refrigeration and heat pumps; exergy

Module grade calculation
The module grade is the grade of the written examination.

Workload
Lectures and exercises: 70 h
Homework: 80 h
Preparation of Examination : 60 h

Recommendation
courses of 1st and 2nd semester

Literature

- Schaber, K.: Skriptum Thermodynamik I (www.ttk.uni-karlsruhe.de)
- Stephan, P., Schaber, K., Stephan, K., Mayinger, F.: Thermodynamik, Band 1 Einstoffsysteme, 18. Aufl., Springer, 2009
- Baehr, H. D.: Thermodynamik, 11.Aufl., Springer, 2002
- Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2006

M 4.49 Module: Thermodynamics II (CIW-TTK-02) [M-CIWVT-101130]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

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

Mandatory			
T-CIWVT-101880	Thermodynamics II, Tutorial	0 CR	Enders
T-CIWVT-101881	Thermodynamics II, Exam	7 CR	Enders

Competence Certificate
The learning control consists of two partial achievements:

1. Written examination lasting 120 min
2. Prerequisite for participation: Completed coursework;
   2 of 3 compulsory exercises have to be approved

Prerequisites
Before taking the written exam, the compleded coursework must be passed.

Competence Goal
Students understand the behavior of real gases, gas-vapor mixtures, simple real mixtures, chemical equilibria of ideal gases. They are able to explain and to analyse corresponding thermodynamic processes by means of state diagrams and process schemes. They are able to analyse and to design these processes based on balance equations and phase equilibria.

Content
Real gases and liquification of gases; thermodynamic potentials; characterization of mixtures; mixtures of ideal gases; gas-vapor mixtures and processes with humid air; phase equilibria and phase diagrams, laws of Raoult and Henry, liquid-liquid equilibria; enthalpy of mixtures; general description of mixtures and chemical potential; reaction equilibria of ideal gases; fundamentals of combustion processes.

Module grade calculation
The module grade is the grade of the written examination.

Workload
Lectures and exercises: 70 h
Homework: 80 h
Preparation of Examination : 60 h

Recommendation
courses of 1st - 3rd semester

Thermodynamics I

Literature

- Stephan, P., Schaber, K., Stephan, K., Mayinger, F.: Thermodynamik, Band 2: Mehrstoffsysteme und chemische Reaktionen, 15. Aufl., Springer, 2010
- Baehr, H. D., Kabelac, S. : Thermodynamik, 14. Aufl., Springer, 2009
- Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2006
- Gmehling, J., Kolbe, B.: Thermodynamik, 2. Auflage, VCH Verlag Weinheim, 1992

5 Courses

T 5.1 Course: Automation and Control Systems Engineering - Exam [T-CIWVT-113088]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106477 - Automation and Control Systems Engineering

Type	Credits	Grading scale	Version
Oral examination	6	Grade to a third	1

Events					
WT 23/24	2243020	Advanced Methods in Linear Control	2+1 SWS	Lecture / Practice (/ 🗣	Meurer
WT 23/24	2243021	Exkursion im Profilfach Automatisierungs- und Regelungstechnik	1 SWS	Excursion (E / 🗣	Meurer

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

T 5.2 Course: Advanced Mathematics I [T-MATH-100275]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-CIWVT-106447 - Orientation Exam
M-MATH-100280 - Advanced Mathematics I

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	3

Events					
WT 23/24	0131000	Höhere Mathematik I für die Fachrichtung Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Hettlich
WT 23/24	0131200	Höhere Mathematik I für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Hettlich
Exams					
WT 23/24	6700007	Advanced Mathematics I			Arens, Griesmaier, Hettlich
ST 2024	6700025	Advanced Mathematics I			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM I is a requirement for registration for the examination in AM I.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100525 - Tutorial Advanced Mathematics I must have been passed.

T 5.3 Course: Advanced Mathematics II [T-MATH-100276]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-100281 - Advanced Mathematics II

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
ST 2024	0180800	Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie, Materialwissenschaft und Werkstofftechnik	4 SWS	Lecture	Arens
ST 2024	0181000	Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und MIT	4 SWS	Lecture	Arens
Exams					
WT 23/24	6700008	Advanced Mathematics II			Arens, Griesmaier, Hettlich
ST 2024	6700001	Advanced Mathematics II			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM II is a requirement for registration for the examination in AM II.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100526 - Tutorial Advanced Mathematics II must have been passed.

T 5.4 Course: Advanced Mathematics III [T-MATH-100277]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-100282 - Advanced Mathematics III

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	2

Events					
WT 23/24	0131400	Höhere Mathematik III für die Fachrichtungen Maschinenbau, Chemieingenieurwesen, Verfahrenstechnik, Bioingenieurwesen und das Lehramt Maschinenbau	4 SWS	Lecture	Arens
Exams					
WT 23/24	6700009	Advanced Mathematics III			Arens, Griesmaier, Hettlich
ST 2024	6700002	Advanced Mathematics III			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written examination of 120 minutes length.

Prerequisites
A "pass" result on the pre-requesite in AM III is a requirement for registration for the examination in AM III.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MATH-100527 - Tutorial Advanced Mathematics III must have been passed.

T 5.5 Course: Air Pollution Control [T-CIWVT-113046]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106448 - Air Pollution Control

Type	Credits	Grading scale	Recurrence	Version
Oral examination	7	Grade to a third	Each summer term	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	7292917	Air Pollution Control			Dittler

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

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

Prerequisites
None

T 5.6 Course: Air Pollution Control - Project Work [T-CIWVT-113047]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106448 - Air Pollution Control

Type	Credits	Grading scale	Version
Examination of another type	5	Grade to a third	1

Events					
ST 2024	2244022	Air Pollution Control - Project Work	2 SWS	Project (P / 🗣	Dittler, und Mitarbeiter
Exams					
WT 23/24	7292977	Air Pollution Control - Project Thesis			Dittler

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

Competence Certificate
Learning control is a project work; examination of another type.

Prerequisites
None

T 5.7 Course: Automation and Control Systems Engineering - Project Work [T-CIWVT-113089]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106477 - Automation and Control Systems Engineering

Type	Credits	Grading scale	Version
Examination of another type	6	Grade to a third	1

Events					
WT 23/24	2243020	Advanced Methods in Linear Control	2+1 SWS	Lecture / Practice (/ 🗣	Meurer
WT 23/24	2243021	Exkursion im Profilfach Automatisierungs- und Regelungstechnik	1 SWS	Excursion (E / 🗣	Meurer
Exams					
WT 23/24	7243022	Automation and Control Systems Engineering - Project Work			Meurer, Jerono

Legend: 🖳 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, × Cancelled

T 5.8 Course: Bachelor's Thesis [T-CIWVT-113255]

Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106580 - Module Bachelor's Thesis

Type	Credits	Grading scale	Version
Final Thesis	12	Grade to a third	1

Final Thesis
This course represents a final thesis. The following periods have been supplied:

Submission deadline	4 months
Maximum extension period	1 months
Correction period	6 weeks

T 5.9 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 stdues
This course can be used for self service assignment of grade aquired 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 5.10 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 stdues
This course can be used for self service assignment of grade aquired 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 an 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 5.11 Course: Biochemistry [T-CIWVT-112997]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106414 - Biology for Engineers

Type	Credits	Grading scale	Recurrence	Version
Written examination	2,5	Grade to a third	Each summer term	1

Events					
WT 23/24	2212110	Biology for Engineers - Biochemistry	2 SWS	Lecture / 🗣	Rudat
Exams					
WT 23/24	7212110-V-BC	BING Biochemistry			Holtmann, Rudat

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

Competence Certificate
Written Examination with a duration of 90 minutes; Section 4, subsection 2 No. 1 SPO.

Prerequisites
None

T 5.12 Course: Biopharmaceutical Process Engineering [T-CIWVT-113023]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106437 - Biopharmaceutical Process Engineering
M-CIWVT-106475 - Biopharmaceutical Process Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	1

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.13 Course: Biopharmaceutical Purification Processes [T-CIWVT-106029]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	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 5.14 Course: Bioprocess Development [T-CIWVT-112766]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	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 5.15 Course: Bioprocess Engineering [T-CIWVT-113019]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Prof. Dr. Jürgen Hubbuch

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-106434 - Bioprocess Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	1

Competence Certificate
Written examination with a duration of 120 minutes (section 4 subsection 2 No. 1 SPO).

T 5.16 Course: Biotechnological Production [T-CIWVT-106030]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each summer term	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	7221-V-410	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 ind biochemistry, genetics, cell biology and microbiology is required.

T 5.17 Course: Biotechnology [T-CIWVT-103669]

Responsible: Dr.-Ing. Iris Perner-Nochta
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101143 - Biotechnology

Type	Credits	Grading scale	Version
Examination of another type	9	Grade to a third	2

Events					
WT 23/24	2214210	Profile Subject Biotechnology - Management of Scientific Projects	2+1 SWS	Lecture / Practice (/ 🗣	Perner-Nochta, Grünberger, und Mitarbeiter
WT 23/24	2214211	Profile Subject Biotechnology - Laboratory Work (2214210)	6 SWS	Practical course / 🗣	Perner-Nochta, Grünberger, und Mitarbeiter
WT 23/24	2214212	Profile Subject Biotechnology - Exercises on Management of Scientific Projects (2214210)	1 SWS	Practice / 🗣	Perner-Nochta, und Mitarbeiter
Exams					
WT 23/24	7223002	Biotechnology			Hubbuch

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

Competence Certificate
Learning control is an examination of another type, project work.

Prerequisites
None

T 5.18 Course: Biotechnology - Seminar [T-CIWVT-113097]

Responsible: Dr.-Ing. Iris Perner-Nochta
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101143 - Biotechnology

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

Events					
WT 23/24	2214214	Proseminar Biotechnology	2 SWS	Seminar / 🗣	Perner-Nochta, Bleher
Exams					
WT 23/24	7200005	Biotechnology - Seminar			Perner-Nochta

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

Prerequisites
None

T 5.19 Course: Cell Biology [T-CIWVT-113037]

Responsible: apl. Prof. Dr. Hans-Eric Gottwald
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106414 - Biology for Engineers
M-CIWVT-106447 - Orientation Exam

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 23/24	2212113	Biology for Engineers - Cell Biology	2 SWS	Lecture / 🗣	Gottwald
Exams					
WT 23/24	7212113-V-ZELL	BING Cell Biology			Gottwald

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

Competence Certificate
Written examination with a duration of 90 minutes (section 4, subsection 2 Nr. 1 SPO).

Prerequisites
None

T 5.20 Course: Chemical Process Engineering [T-CIWVT-101884]

Responsible: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101133 - Chemical Process Engineering

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

Events					
WT 23/24	2220010	Chemical Process Engineering	2 SWS	Lecture / 🗣	Wehinger
WT 23/24	2220011	Exercises on 2220010 Chemical Process Engineering	2 SWS	Practice / 🗣	Wehinger, Kutscherauer, und Mitarbeiter
WT 23/24	2220012	Repetitorium zur Klausur Chemische Verfahrenstechnik	2 SWS	Practice / 💻	Wehinger, und Mitarbeiter
ST 2024	2220012	Repetitorium zur Klausur Chemische Verfahrenstechnik	2 SWS	Practice / 💻	Wehinger, und Mitarbeiter
Exams					
WT 23/24	7210101	Chemical Process Engineering			Wehinger
ST 2024	7210101	Chemical Process Engineering			Wehinger

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.21 Course: Circular Economy - Oral Exam [T-CIWVT-112172]

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-105995 - Circular Economy

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each winter term	1

Events					
WT 23/24	2232220	Circular Economy	2 SWS	Lecture / 🗣	Stapf
WT 23/24	2232221	Exercises on 2232220 Circular Economy	1 SWS	Practice / 🗣	Stapf
Exams					
ST 2024	7231003	Circular Economy - Oral Exam			Stapf

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

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

Prerequisites
None.

T 5.22 Course: Circular Economy - Project Work [T-CIWVT-112173]

Responsible: Prof. Dr.-Ing. Dieter Stapf
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-105995 - Circular Economy

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	1

Events					
ST 2024	2232222	Circular Economy - Project Work	2 SWS	Project (P / 🗣)	Stapf, und Mitarbeiter
Exams					
WT 23/24	7231004	Circular Economy - Project Work			Stapf

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

Competence Certificate
Learning control is an examination of another type. The following partial aspects are included in the grading: Term paper and presentation.

Prerequisites
None.

T 5.23 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-101991 - Single Results

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	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 5.24 Course: Control Engineering and System Dynamics [T-CIWVT-112787]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106308 - Control Engineering and System Dynamics

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

Events					
ST 2024	2243010	Control Engineering and System Dynamics	2 SWS	Lecture / 🗣	Meurer
ST 2024	2243011	Exercises on Control Engineering and System Dynamics	1 SWS	Practice / 🗣	Meurer, und Mitarbeiter
ST 2024	2243012	Tutorium zu Regelungstechnik und Systemdynamik	1 SWS	Tutorial (/ 🗣	Meurer, und Mitarbeiter
Exams					
WT 23/24	7294000	Control Engineering and System Dynamics			Meurer
ST 2024	7243010	Control Engineering and System Dynamics			Meurer
ST 2024	7276-T-MACH-102126	Control Engineering and System Dynamics			Stiller, Meurer

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

T 5.25 Course: Data Analysis [T-CIWVT-113039]

Responsible: apl. Prof. Dr. Gisela Guthausen
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106432 - Data Analysis

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

Prerequisites
None

T 5.26 Course: Design of Machines [T-CIWVT-103641]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101941 - Design of Machines

Type	Credits	Grading scale	Version
Completed coursework	0	pass/fail	1

Events					
ST 2024	2245210	Design of Machines	3 SWS	Lecture / 🗣	Gleiß
Exams					
WT 23/24	7291959	Design of Machines			Nirschl
ST 2024	7291959	Design of Machines			Gleiß

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

Competence Certificate
The Learning control is a completed coursework (ungraded).

Prerequisites
None

T 5.27 Course: Design of Machines, Exam [T-CIWVT-103642]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101941 - Design of Machines

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	1

Events					
ST 2024	2245210	Design of Machines	3 SWS	Lecture / 🗣	Gleiß
Exams					
WT 23/24	7291957	Design of Machines			Gleiß
ST 2024	7291957	Apparatus Design			Gleiß

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

Competence Certificate
Written examination lasting 120 minutes.

Prerequisites
Preparatory

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-103641 - Design of Machines must have been passed.

T 5.28 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 5.29 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 5.30 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 5.31 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.

T 5.32 Course: Electrochemical Energy Technologies [T-ETIT-111352]

Responsible: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105690 - Electrochemical Energy Technologies

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	1

Events					
WT 23/24	2304236	Electrochemical Energy Technologies	2 SWS	Lecture / 🗣	Krewer
WT 23/24	2304237	Exercise for 2304236 Electrochemical Energy Technologies	1 SWS	Practice / 🗣	Krewer
Exams					
WT 23/24	7300002	Electrochemical Energy Technologies			Krewer
ST 2024	7300009	Electrochemical Energy Technologies			Krewer

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

Competence Certificate
Type of Examination: Written exam
Duration of Examination: approx. 120 minutes

Prerequisites
none

T 5.33 Course: Energy and Environmental Engineering [T-CIWVT-108254]

Responsible: Prof. Dr. Reinhard Rauch
Prof. Dr.-Ing. Dimosthenis Trimis

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-101145 - Energy and Environmental Engineering

Type	Credits	Grading scale	Version
Written examination	8	Grade to a third	1

Events					
WT 23/24	2231150	Verfahren zur Erzeugung chemischer Energieträger	2 SWS	Lecture / 🗣	Rauch
WT 23/24	2232050	Fundamentals of High Temperature Energy Conversion	2 SWS	Lecture / 🗣	Trimis
Exams					
ST 2024	7230500	Energy and Environmental Engineering			Trimis, Rauch

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.34 Course: Energy and Environmental Engineering Project Work [T-CIWVT-103527]

Responsible: Prof. Dr. Reinhard Rauch
Prof. Dr.-Ing. Dimosthenis Trimis
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101145 - Energy and Environmental Engineering

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	1

Events					
ST 2024	2231151	Projektarbeit im Profilfach Energie- und Umwelttechnik	3 SWS	Project (P / 🗣	Rauch, Trimis, Kolb
Exams					
WT 23/24	7230501	Energy and Environmental Engineering Project Work			Rauch, Trimis

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

Competence Certificate
The learning control is an examination of another type; project work.

Prerequisites
None

T 5.35 Course: Energy Process Engineering [T-CIWVT-101889]

Responsible: Prof. Dr.-Ing. Thomas Kolb
Prof. Dr. Oliver Thomas Stein

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-101136 - Energy Process Engineering

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

Events					
WT 23/24	2232110	Energy Process Engineering	2 SWS	Lecture /	Stein, Kolb
WT 23/24	2232111	Exercises on 2232110 Energy Process Engineering	1 SWS	Practice /	Stein, Kolb, und Mitarbeiter
Exams					
WT 23/24	7231109	Energy Process Engineering			
WT 23/24	7231110	Energy Process Engineering			Kolb, Stein
ST 2024	7230110	Energy Process Engineering			Kolb, Stein

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

Competence Certificate
Learning control is a written examination lasting 150 minutes.

Prerequisites
None

T 5.36 Course: Engineering Mechanics: Dynamics [T-CIWVT-106290]

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101128 - Engineering Mechanics: Dynamics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each winter term	1

Events					
WT 23/24	2241010	Engineering Mechanics: Dynamics	2 SWS	Lecture / 🗣	Klahn
WT 23/24	2241011	Exercises on 2241010 Engineering Mechanics: Dynamics	2 SWS	Practice / 🗣	Klahn, Rentschler
WT 23/24	2241012	Tutorium zu 2241010 Technische Mechanik: Dynamik	1 SWS	Tutorial (/ 🗣	Klahn
Exams					
WT 23/24	7210201	Engineering Mechanics: Dynamics			Dittmeyer

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

Competence Certificate
The learning control is a completed coursework: 3 of 4 exercises have to be passed.

T 5.37 Course: Engineering Mechanics: Dynamics, Exam [T-CIWVT-101877]

Responsible: TT-Prof. Dr. Christoph Klahn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101128 - Engineering Mechanics: Dynamics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each term	2

Events					
WT 23/24	2241010	Engineering Mechanics: Dynamics	2 SWS	Lecture / 🗣	Klahn
WT 23/24	2241011	Exercises on 2241010 Engineering Mechanics: Dynamics	2 SWS	Practice / 🗣	Klahn, Rentschler
WT 23/24	2241012	Tutorium zu 2241010 Technische Mechanik: Dynamik	1 SWS	Tutorial (/ 🗣	Klahn
Exams					
WT 23/24	7210200	Engineering Mechanics: Dynamics, Exam			Klahn
ST 2024	7210200	Engineering Mechanics: Dynamics, Exam			Klahn

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

Competence Certificate
Learming control is a written examination lasting 120 minutes.

Prerequisites
Prerequisite: 3 of 4 exercises have to be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-106290 - Engineering Mechanics: Dynamics must have been passed.

T 5.38 Course: Engineering Mechanics: Statics [T-CIWVT-111054]

Responsible: Dr.-Ing. Bernhard Hochstein
Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-105846 - Engineering Mechanics: Statics

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each winter term	1

Events					
WT 23/24	2242210	Engineering Mechanics: Statics	2 SWS	Lecture / 🗣	Willenbacher, Hochstein, Oelschlaeger
WT 23/24	2242211	Exercises on 2242210 Engineering Mechanics: Statics	2 SWS	Practice / 🗣	Oelschlaeger, Hochstein, und Mitarbeiter
Exams					
WT 23/24	7290003	Engineering Mechanics: Statics			Hochstein
ST 2024	7290003	Engineering Mechanics: Statics			Hochstein

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

Prerequisites
None

T 5.39 Course: Excercises: 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-101991 - Single Results

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

Events					
ST 2024	2233011	Membrane Technologies in Water Treatment - Excercises	1 SWS	Practice /	Horn, Saravia, und Mitarbeiter
Exams					
ST 2024	7232609	Excursions 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 5.40 Course: Exercises Process Development and Scale-up [T-CIWVT-111005]

Responsible: Prof. Dr.-Ing. Jörg Sauer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101153 - Process Development and Scale-up

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each winter term	1

Exams			
WT 23/24	7200027	Exercises Process Development and Scale-up	Sauer

T 5.41 Course: Fluiddynamics, Exam [T-CIWVT-101882]

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101131 - Fluiddynamics

Type	Credits	Grading scale	Version
Written examination	5	Grade to a third	1

Events					
ST 2024	2245010	Fluiddynamics	2 SWS	Lecture /	Nirschl
ST 2024	2245011	Fluiddynamics - Exercises	2 SWS	Practice /	Nirschl
Exams					
WT 23/24	7291944	Fluiddynamics			Nirschl
ST 2024	7291944	Fluiddynamics			Nirschl

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-101904 - Fluiddynamics, Tutorial must have been passed.

T 5.42 Course: Fluiddynamics, Tutorial [T-CIWVT-101904]

Responsible: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101131 - Fluiddynamics

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each summer term	1

Events					
ST 2024	2245010	Fluiddynamics	2 SWS	Lecture / 🗣	Nirschl
ST 2024	2245011	Fluiddynamics - Exercises	2 SWS	Practice / 🗣	Nirschl
Exams					
WT 23/24	7291943	Fluiddynamics, Tutorial			Nirschl
ST 2024	7291943	Fluiddynamics, Tutorial			Nirschl

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

Competence Certificate
Learning control is a completed coursework.

T 5.43 Course: Food Bioprocess Engineering [T-CIWVT-113021]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106436 - Food Bioprocess Engineering
M-CIWVT-106476 - Food Bioprocess Engineering

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Exams			
WT 23/24	7220006	Food Biotechnology	Karbstein

Competence Certificate
This module is sucessfully completed by a written exam of 120 min.

Prerequisites
Keine.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-113041 - Food Bioprocess Engineering - Prerequisite must have been passed.

T 5.44 Course: Food Bioprocess Engineering - Prerequisite [T-CIWVT-113041]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106436 - Food Bioprocess Engineering
M-CIWVT-106476 - Food Bioprocess Engineering

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each winter term	1

Exams			
WT 23/24	7220005	Food Biotechnology - Prerequisite	Karbstein

Prerequisites
none

T 5.45 Course: Food Bioprocess Engineering Lab [T-CIWVT-113022]

Responsible: Prof. Dr.-Ing. Heike Karbstein
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106436 - Food Bioprocess Engineering

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-113041 - Food Bioprocess Engineering - Prerequisite must have been passed.

T 5.46 Course: Food Technology [T-CIWVT-103528]

Responsible: Dr.-Ing. Nico Leister
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101148 - Food Technology

Type	Credits	Grading scale	Recurrence	Version
Written examination	5	Grade to a third	Each summer term	2

Events					
WT 23/24	2211040	Einführung in das Profilfach Lebensmitteltechnologie	1 SWS	Lecture / 🗣	Karbstein, Ellwanger, und Mitarbeiter
WT 23/24	2211041		1 SWS	Project (P / 🗣	Karbstein, Ellwanger, und Mitarbeiter
ST 2024	2211042	Übung zu 2211041 Projektarbeit im Profilfach Lebensmitteltechnologie	1 SWS	Practice / 🗣	Leister, und Mitarbeiter
ST 2024	2211043	Exkursion im Profilfach Lebensmitteltechnologie	1 SWS	Excursion (E / 🗣	Leister, und Mitarbeiter
Exams					
WT 23/24	7220010	Food Technology			Karbstein

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

Competence Certificate
Learning control is a written examination with a duration of 60 minutes.

Prerequisites
None.

T 5.47 Course: Food Technology Project Work [T-CIWVT-103529]

Responsible: Dr.-Ing. Nico Leister
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101148 - Food Technology

Type	Credits	Grading scale	Version
Examination of another type	7	Grade to a third	1

Events					
ST 2024	2211041	Projektarbeit im Profilfach Lebensmitteltechnologie	4 SWS	Project (P / 🗣)	Leister, und Mitarbeiter
Exams					
WT 23/24	7220011	Food Technology Project Work			Karbstein

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

Competence Certificate
Learning control is a projekt work/ examination of another type.

Prerequisites
None

T 5.48 Course: Fundamentals of Heat and Mass Transfer [T-CIWVT-101883]

Responsible: Prof. Dr.-Ing. Wilhelm Schabel
Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101132 - Fundamentals of Heat and Mass Transfer

Type	Credits	Grading scale	Recurrence	Version
Written examination	7	Grade to a third	Each term	1

Events					
ST 2024	2260030	Heat and Mass Transfer	3 SWS	Lecture / 🗣	Wetzel, Schabel
ST 2024	2260031	Heat and Mass Transfer - Exercises	2 SWS	Practice / 🗣	Wetzel, Schabel, und Mitarbeiter
Exams					
WT 23/24	7280001	Fundamentals of Heat and Mass Transfer			Wetzel, Schabel
ST 2024	7280001	Fundamentals of Heat and Mass Transfer			Wetzel, Schabel

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

Competence Certificate
Learning control is a written examination lasting 180 minutes.

Prerequisites
None

T 5.49 Course: Fundamentals of Refrigeration, Oral Examination [T-CIWVT-109117]

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-104457 - Fundamentals of Refrigeration

Type	Credits	Grading scale	Recurrence	Version
Oral examination	6	Grade to a third	Each summer term	3

Events					
WT 23/24	2250110	Refrigeration A	2 SWS	Lecture / 🗣	Grohmann
WT 23/24	2250111	Refrigeration A - Exercises	1 SWS	Practice / 🗣	Grohmann, und Mitarbeiter
Exams					
WT 23/24	7250110	Fundamentals of Refrigeration, oral examination			Grohmann
ST 2024	7200005	Fundamentals of Refrigeration, oral examination			Grohmann

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

Competence Certificate
Learning Control is an oral examination about the lecture "Grundlagen der Kältetechnik" lasting approx. 30 minutes.

Prerequisites
Projects Work

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-109118 - Fundamentals of Refrigeration, Project Work must have been started.

T 5.50 Course: Fundamentals of Refrigeration, Project Work [T-CIWVT-109118]

Responsible: Prof. Dr.-Ing. Steffen Grohmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-104457 - Fundamentals of Refrigeration

Type	Credits	Grading scale	Version
Examination of another type	6	Grade to a third	1

Events					
ST 2024	2250112	Projektarbeit zum Profilfach Thermodynamik und Kältetechnik	2 SWS	Practice / 🗣	Grohmann
Exams					
WT 23/24	7250112	Fundamentals of Refrigeration, Project Work			Grohmann
ST 2024	7200006	Fundamentals of Refrigeration, Project Work			Grohmann

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

Competence Certificate
Learning control is a completed coursework: groupwork, project presentation.

Prerequisites
None

T 5.51 Course: General Chemistry and Chemistry of Aqueous Solutions [T-CIWVT-101892]

Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106431 - General Chemistry and Chemistry of Aqueous Solutions

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each winter term	1

Events					
WT 23/24	2233050	General Chemistry and Chemistry in Aqueous Solutions	3 SWS	Lecture / 🗣	Horn
WT 23/24	2233051	Excercises to 2233050: General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Practice / 🗣	Horn, Guthausen, Wagner
WT 23/24	2233052	Tutorial A to 2233050: General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Tutorial (/ 🗣	Guthausen, Wagner
WT 23/24	2233053	Tutorial B to 2233050: General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Tutorial (/ 🗣	Guthausen, Wagner
Exams					
WT 23/24	7232667	General Chemistry and Chemistry of Aqueous Solutions			Horn, Guthausen
WT 23/24	7232668	General Chemistry and Chemistry of Aqueous Solutions			Horn, Guthausen

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

Competence Certificate
Learning control is a written exam lasting 150 minutes to lecture " General Chemistry and Chemistry of Aqueous Solutions" (lecture 3 SWS, exercises 2 SWS).

Prerequisites
None

T 5.52 Course: Genetics [T-CIWVT-111063]

Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106414 - Biology for Engineers
M-CIWVT-106447 - Orientation Exam

Type	Credits	Grading scale	Recurrence	Version
Written examination	2	Grade to a third	Each winter term	1

Events					
WT 23/24	2212111	Biology for Engineers - Genetics	2 SWS	Lecture / 🗣	Neumann
Exams					
WT 23/24	7212114-V-GEN	Genetics			Neumann
ST 2024	7212114-V-GEN	Genetics			Neumann

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

Competence Certificate
Written examination with a duration of 90 minutes (section 4 subsection 2 No. 1 SPO).

Prerequisites
None

T 5.53 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 5.54 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 5.55 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 5.56 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 5.57 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 stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 5.58 Course: Industrial Organic Chemistry [T-CIWVT-101890]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101137 - Industrial Organic Chemistry

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

Events					
WT 23/24	2231140	Organic Chemical Process Science	3 SWS	Lecture / 🗣	Rauch
WT 23/24	2231141	Exercises on 2231140 Organical Chemical Process Science	1 SWS	Practice / 🗣	Rauch
Exams					
WT 23/24	7223703	Industrial Organic Chemistry			Rauch
ST 2024	7223703	Industrial Organic Chemistry			Rauch

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-CHEMBIO-101115 - Organic Chemistry for Engineers must have been started.

T 5.59 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-101991 - Single Results

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 5.60 Course: Intensification of Bioprocesses - Written Exam [T-CIWVT-112998]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106416 - Intensification of Bioprocesses
M-CIWVT-106444 - Intensification of Bioprocesses

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

T 5.61 Course: Intensivication of Bioprocesses - Lab [T-CIWVT-112999]

Responsible: Prof. Dr.-Ing. Dirk Holtmann
Dr. Anke Neumann

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-106416 - Intensification of Bioprocesses

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

T 5.62 Course: Internship [T-CIWVT-106036]

Responsible: Dr.-Ing. Siegfried Bajohr
Dr.-Ing. Barbara Freudig
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Version
Completed coursework	14	pass/fail	1

Exams			
WT 23/24	7200000	Internship	Bajohr

T 5.63 Course: Introduction into Bioengineering [T-CIWVT-113018]

Responsible: Prof. Dr.-Ing. Alexander Grünberger
Prof. Dr.-Ing. Dirk Holtmann
Prof. Dr. Jürgen Hubbuch
Prof. Dr.-Ing. Heike Karbstein

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-106433 - Introduction into Bioengineering

Type	Credits	Grading scale	Version
Written examination	5	Grade to a third	1

Exams			
ST 2024	7210010	Introduction into Bioengineering	Grünberger, Holtmann, Hubbuch, Karbstein

Prerequisites
None

T 5.64 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-101991 - Single Results

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	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 5.65 Course: Laboratory Work: Downstream Processing [T-CIWVT-113024]

Responsible: Prof. Dr. Jürgen Hubbuch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106437 - Biopharmaceutical Process Engineering

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	1

Competence Certificate
Learning control is an examination of another type.

Prerequisites
None

T 5.66 Course: Laboratory Work: General Chemistry [T-CIWVT-113015]

Responsible: Dr. Gudrun Abbt-Braun
Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106427 - Basic Practical Course in Natural Sciences

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

Events					
WT 23/24	2233054	Naturwissenschaftliches Grundpraktikum - Teil I: Allgemeine Chemie	2 SWS	Practical course / 🗣	Horn, Abbt-Braun
Exams					
WT 23/24	7233054	Laboratory Work: General Chemistry			Horn, Abbt-Braun

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

Prerequisites
Written exam "General Chemistry and Chemistry of Aqueous Solutions" must be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-101892 - General Chemistry and Chemistry of Aqueous Solutions must have been passed.

T 5.67 Course: Laboratory Work: Microbiology for Engineers [T-CIWVT-113014]

Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106427 - Basic Practical Course in Natural Sciences

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

Events					
WT 23/24	2212150	Naturwissenschaftliches Grundpraktikum - Teil II: Mikrobiologie	2 SWS	Practical course / 🗣	Neumann
Exams					
WT 23/24	7212150-GP2-MIBI	Laboratory Work: Microbiology for Engineers			Neumann

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

Prerequisites

- The written exam General Chemistry and Chemistry in Aqueous Solutions must be passed.
- Participation in the Laboratory Work: General Chemistry

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-101892 - General Chemistry and Chemistry of Aqueous Solutions must have been passed.

T 5.68 Course: Mathematical Modeling for Biochemical Engineering [T-MATH-113040]

Responsible: PD Dr. Gudrun Thäter
Organisation: KIT Department of Mathematics
Part of: M-MATH-106443 - Mathematical Modeling for Biochemical Engineering

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	1

T 5.69 Course: Mechanical Processing [T-CIWVT-101886]

Responsible: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101135 - Mechanical Processing

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	1

Events					
WT 23/24	2244010	Mechanical Processing	2 SWS	Lecture / 🗣	Dittler
WT 23/24	2244011	Exercises on 2244010 Mechanical Processing	2 SWS	Practice / 🗣	Dittler, und Mitarbeiter
Exams					
WT 23/24	7292901	Mechanical Processing			Dittler
ST 2024	7292901	Mechanical Processing			Dittler

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.70 Course: Mechanical Separation Technology Exam [T-CIWVT-103448]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101147 - Mechanical Separation Technology

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	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	7291231	Mechanical Separation Technology Exam			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 5.71 Course: Mechanical Separation Technology Project Work [T-CIWVT-103452]

Responsible: Dr.-Ing. Marco Gleiß
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101147 - Mechanical Separation Technology

Type	Credits	Grading scale	Version
Examination of another type	4	Grade to a third	1

Events					
ST 2024	2245232	Project Work for Profile Subject Mechanical Separation Techniques	1 SWS	Practice / 🗣	Gleiß, und Mitarbeiter
Exams					
WT 23/24	7291300	Mechanical Separation Technology Project Work			Gleiß

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

Competence Certificate
Learning control is a project work; examination of another type.

Prerequisites
none

T 5.72 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-101991 - Single Results

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 - Excercises	1 SWS	Practice /	Horn, Saravia, und Mitarbeiter
Exams					
WT 23/24	7232605	Membrane Technologies in Water Treatment			Horn, Saravia
ST 2024	7232605	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 - Excercises: Membrane Technologies must have been passed.

T 5.73 Course: Micro Process Engineering [T-CIWVT-103666]

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101154 - Micro Process Engineering

Type	Credits	Grading scale	Recurrence	Version
Oral examination	7	Grade to a third	Each summer term	1

Events					
WT 23/24	2220220	Design of Micro Reactors	4 SWS	Lecture / Practice (/	Pfeifer
Exams					
ST 2024	7210201	Micro Process Engineering			Pfeifer

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

Competence Certificate
Die Erfolgskontrolle ist eine mündliche Einzelprüfung nach § 4 Abs. 2 Nr. 2 der SPO Bachelor Bioingenieurwesen 2015 im Umfang von ca. 25 Minuten zu Lehrveranstaltung "Auslegung von Mikroreaktoren".

Prerequisites
None

T 5.74 Course: Micro Process Engineering [T-CIWVT-103667]

Responsible: Prof. Dr.-Ing. Peter Pfeifer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101154 - Micro Process Engineering

Type	Credits	Grading scale	Version
Examination of another type	5	Grade to a third	1

Events					
ST 2024	2220221	Projektarbeit im Profilfach Mikroverfahrenstechnik	2 SWS	Practice / 🗣	Pfeifer, und Mitarbeiter
Exams					
ST 2024	7210202	Micro Process Engineering			Pfeifer

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

Competence Certificate
Die Erfolgskontrolle ist eine Prüfungsleistung anderer Art (Projektarbeit) nach § 4 Abs. 2 Nr. 3 der SPO Bachelor Bioingenieurwesen 2015. Es werden die praktische Mitarbeit, der schriftliche Bericht sowie die mündliche Präsentation der Ergebnisse individuell bewertet.

Prerequisites
None

T 5.75 Course: Microbiology [T-CIWVT-113038]

Responsible: Dr. Anke Neumann
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106414 - Biology for Engineers

Type	Credits	Grading scale	Recurrence	Version
Written examination	2,5	Grade to a third	Each winter term	1

Events					
WT 23/24	2212112	Biology for Engineers - Microbiology	2 SWS	Lecture / 🗣	Neumann
Exams					
WT 23/24	7212112-V-MIBI	BING Microbiology			Neumann, Holtmann
ST 2024	7212112-V-MIBI	BING Microbiology			Neumann, Holtmann

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

Competence Certificate
Written Examination with a duration of 90 minutes.

T 5.76 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	Credits	Grading scale	Version
Oral examination	4	Grade to a third	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 5.77 Course: Oral Exam - Supplementary Studies on Sustainable Development [T-ZAK-112351]

Organisation:

Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	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 5.78 Course: Organic Chemistry for Engineers [T-CHEMBIO-101865]

Responsible: Prof. Dr. Michael Meier
Organisation: KIT Department of Chemistry and Biosciences
Part of: M-CHEMBIO-101115 - Organic Chemistry for Engineers

Type	Credits	Grading scale	Version
Written examination	5	Grade to a third	2

Events					
ST 2024	5142	Organische Chemie für CIW/VT und BIW	2 SWS	Lecture / 🗣	Levkin
ST 2024	5143	Übungen zu Organische Chemie für CIW/VT und BIW	2 SWS	Practice / 🗣	Levkin
Exams					
WT 23/24	7100023	Organic Chemistry for Engineers			Meier
ST 2024	7100017	Organic Chemistry for CIW, BIW, VT und MWT			Levkin, Podlech
ST 2024	7100029	Organic Chemistry for CIW, BIW, VT und MWT, second exam			Levkin, Podlech

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

Prerequisites
acc. to module description

T 5.79 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-101991 - Single Results

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	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 5.80 Course: Physical Chemistry (Lab) [T-CHEMBIO-109179]

Responsible: Dr. Tomas Kubar
Dr. Benno Meier
Organisation: KIT Department of Chemistry and Biosciences
Part of: M-CIWVT-101991 - Single Results

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 5.81 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-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Recurrence	Version
Written examination	4	Grade to a third	Each winter term	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 5.82 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-101991 - Single Results

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
Compleded 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 5.83 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 5.84 Course: Process Development and Scale-up [T-CIWVT-103530]

Responsible: Prof. Dr.-Ing. Jörg Sauer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101153 - Process Development and Scale-up

Type	Credits	Grading scale	Recurrence	Version
Oral examination	8	Grade to a third	Each summer term	2

Events					
WT 23/24	2231310	Process Development and Scale-Up	2 SWS	Lecture / 🗣	Sauer
WT 23/24	2231311	Exercises on 2231310 Process Development and Scale-Up	2 SWS	Practice / 🗣	Sauer, und Mitarbeiter
Exams					
ST 2024	7200025	Process Development and Scale-up			Sauer

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-111005 - Exercises Process Development and Scale-up must have been passed.

T 5.85 Course: Process Development and Scale-up Project Work [T-CIWVT-103556]

Responsible: Prof. Dr.-Ing. Jörg Sauer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101153 - Process Development and Scale-up

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	4	Grade to a third	Each summer term	1

Events					
ST 2024	2231312	Project Work in the Profile Course "Process Development and Scale-up"	2 SWS	Project (P / 🗣	Sauer, und Mitarbeiter
ST 2024	2231313	Presentation Profile Course "Process Development and Scale-up"		Lecture / 🗣	Sauer
Exams					
ST 2024	7200026	Process Development and Scale-up Project Work			Sauer

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

Prerequisites
none

T 5.86 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-101991 - Single Results

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 5.87 Course: Programming and Numeric Simulation [T-CIWVT-113025]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106438 - Programming and Numeric Simulation

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

Events					
ST 2024	2243080	Programming and Numeric Simulation Using MATLAB	2 SWS	Lecture / 🗣	Meurer, Jerono
Exams					
ST 2024	7243080	Programming and Numeric Simulation - Exam			Meurer, Jerono

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-113074 - Programming and Numeric Simulation Using MATLAB - Ecercises must have been passed.

T 5.88 Course: Programming and Numeric Simulation Using MATLAB - Ecercises [T-CIWVT-113074]

Responsible: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106438 - Programming and Numeric Simulation

Type	Credits	Grading scale	Version
Completed coursework	2	pass/fail	1

Events					
ST 2024	2243080	Programming and Numeric Simulation Using MATLAB	2 SWS	Lecture / 🗣	Meurer, Jerono
Exams					
ST 2024	7243081	Programming and Numeric Simulation - Examination Prerequisite			Meurer, Jerono

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

T 5.89 Course: Scientific Writing with LaTeX [T-HOC-113121]

Responsible: Andreas Hirsch-Weber
Organisation:
Part of: M-HOC-106502 - Scientific Writing with LaTeX

Type	Credits	Grading scale	Version
Completed coursework	2	pass/fail	1

T 5.90 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-101991 - Single Results

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	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			Karbstein, Leister

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

Competence Certificate
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.91 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-101991 - Single Results

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
Conpleted coursework: Seminar talk.

Prerequisites
None

T 5.92 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 stdues
This course can be used for self service assignment of grade aquired 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 5.93 Course: Thermal Process Engineering [T-CIWVT-101885]

Responsible: Prof. Dr.-Ing. Matthias Kind
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101134 - Thermal Process Engineering

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	1

Events					
WT 23/24	2260110	Thermal Process Engineering	2 SWS	Lecture /	Kind, Dietrich
WT 23/24	2260111	Exercises for 2260110 Thermal Process Engineering	2 SWS	Practice /	Kind, Dietrich, und Mitarbeiter
Exams					
WT 23/24	7280002	Thermal Process Engineering			Kind
ST 2024	7280002	Thermal Process Engineering			Dietrich

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

T 5.94 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-101991 - Single Results

Type	Credits	Grading scale	Recurrence	Version
Written examination	6	Grade to a third	Each term	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 5.95 Course: Thermodynamics I, Exam [T-CIWVT-101879]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101129 - Thermodynamics I

Type	Credits	Grading scale	Version
Written examination	7	Grade to a third	1

Events					
WT 23/24	2250010	Thermodynamics I	3 SWS	Lecture / 🗣	Enders
WT 23/24	2250011	Thermodynamics I - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeiter
WT 23/24	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeiter
Exams					
WT 23/24	7200002	Thermodynamics I Exam			Enders
ST 2024	7200002	Thermodynamics I Exam			Enders

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

Competence Certificate
Learning control is a written examination lastin 120 minutes.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-101878 - Thermodynamics I, Tutorial must have been passed.

T 5.96 Course: Thermodynamics I, Tutorial [T-CIWVT-101878]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101129 - Thermodynamics I

Type	Credits	Grading scale	Version
Completed coursework	0	pass/fail	1

Events					
WT 23/24	2250010	Thermodynamics I	3 SWS	Lecture / 🗣	Enders
WT 23/24	2250011	Thermodynamics I - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeiter
WT 23/24	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeiter
Exams					
WT 23/24	7200001	Thermodynamics I, Tutorial			Enders

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

Prerequisites
None

T 5.97 Course: Thermodynamics II, Exam [T-CIWVT-101881]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101130 - Thermodynamics II

Type	Credits	Grading scale	Version
Written examination	7	Grade to a third	1

Events					
ST 2024	2250020	Thermodynamics II	3 SWS	Lecture / 🗣	Enders
ST 2024	2250021	Thermodynamics II - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeiter
ST 2024	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, Bergmann, Rees, und Mitarbeiter
Exams					
WT 23/24	7200004	Thermodynamics II, Exam			Enders
ST 2024	7200004	Thermodynamics II, Exam			Enders

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

Competence Certificate
Learning control is a written examination lastin 120 minutes.

Prerequisites
Precondition for participation: 2 of 3 compulsory exercises have to be approved

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-CIWVT-101880 - Thermodynamics II, Tutorial must have been passed.

T 5.98 Course: Thermodynamics II, Tutorial [T-CIWVT-101880]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101130 - Thermodynamics II

Type	Credits	Grading scale	Version
Completed coursework	0	pass/fail	1

Events					
ST 2024	2250020	Thermodynamics II	3 SWS	Lecture /	Enders
ST 2024	2250021	Thermodynamics II - Exercises	2 SWS	Practice /	Enders, und Mitarbeiter
ST 2024	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/	Enders, Bergmann, Rees, und Mitarbeiter
Exams					
ST 2024	7200003	Thermodynamics II, Tutorial			Enders

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

Competence Certificate
The learning control is a completed coursework; prerequisite for the written exam.

Prerequisites
None

T 5.99 Course: Thermodynamics III [T-CIWVT-106033]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading scale	Version
Written examination	6	Grade to a third	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 5.100 Course: Tutorial Advanced Mathematics I [T-MATH-100525]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-CIWVT-106447 - Orientation Exam
M-MATH-100280 - Advanced Mathematics I

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 23/24	0131100	Übungen zu 0131000	2 SWS	Practice	Hettlich
WT 23/24	0131300	Übungen zu 0131200	2 SWS	Practice	Hettlich
Exams					
WT 23/24	6700005	Problem Class for Advanced Mathematics I			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 5.101 Course: Tutorial Advanced Mathematics II [T-MATH-100526]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-100281 - Advanced Mathematics II

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each summer term	2

Events					
ST 2024	0180900	Übungen zu 0180800	2 SWS	Practice	Arens
ST 2024	0181100	Übungen zu 0181000	2 SWS	Practice	Arens
Exams					
ST 2024	7700024	Problem Class for Advanced Mathematics II			Hettlich, Arens, Griesmaier

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 5.102 Course: Tutorial Advanced Mathematics III [T-MATH-100527]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-100282 - Advanced Mathematics III

Type	Credits	Grading scale	Recurrence	Version
Completed coursework (written)	0	pass/fail	Each winter term	2

Events					
WT 23/24	0131500	Übungen zu 0131400	2 SWS	Practice	Arens
Exams					
WT 23/24	6700006	Tutorial Advanced Mathematics III			Arens, Griesmaier, Hettlich

Competence Certificate
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.