Karlsruher Institut für Technologie

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

SPO 2023

Winter semester 2025/26

Date: 03/09/2025

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 semesters	6 semesters
Maximum semesters	12 semesters
Credits	180
Language	German
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. https://www.ciw.kit.edu/english/4102.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

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 **27**	Advanced Mathematics I (7) General Chemistry and Chemistry of Aqueous Solutions (6) Biology für Engineers (7) - Cell Biology - Biochemistry - Genetics Basic Pracital Course (2) - Generyl Chemistry	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 **31**	Advanced Mathematics III (7) Data Analysis (3) Basic Pracital Course (2) - Mikrobiology	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	West, 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, Holtmann, Hubbuch, Leister	4	5
	Bioprocess Engineering		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	Jerono	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	-	-	-	-	-	4	0	-	5	K
Basic Practical Course in Natural Sciences	-	-	2	2	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	-	-	-	-	-
Basic Practical Course in Natural Sciences	-	-	2	2	S	-	-	-	-	-
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 Study Program Structure

Mandatory	
Orientation Exam *This field will not influence the calculated grade of its parent.*	
Bachelor's Thesis	12 CP
Fundamentals of Mathematics and Natural Sciences	52 CP
Fundamentals of Scientific Engineering	48 CP
Fundamentals of Process Engineering	22 CP
Specialization/ Process Engineering	28 CP
Specialization/ Project Work	12 CP
Interdisciplinary Qualifications	6 CP
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	DE	WS+SS	0 CP

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	DE	WS+SS	12 CP

3.3 Fundamentals of Mathematics and Natural Sciences

Credits
52

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

3.4 Fundamentals of Scientific Engineering

Credits
48

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

3.5 Fundamentals of Process Engineering

Credits
22

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

3.6 Specialization/ Process Engineering

Credits
28

Specialization Bioprocess Engineering (Election: 18 credits)				
M-CIWVT-106437	Biopharmaceutical Process Engineering	DE	SS	9 CP
M-CIWVT-106416	Intensification of Bioprocesses	DE	SS	9 CP
M-CIWVT-106436	Food Bioprocess Engineering	DE	WS	9 CP
M-CIWVT-107406	Bioprocess Development	DE	WS	9 CP
Specialization Process Engineering (Election: at least 10 credits)				
M-CIWVT-103297	Applied Apparatus Engineering *First usage possible from Apr 01, 2025.*	DE	SS	5 CP
M-CIWVT-106475	Biopharmaceutical Process Engineering	DE	SS	6 CP
M-CIWVT-107403	Bioprocess Development	DE	WS	6 CP
M-ETIT-105690	Electrochemical Energy Technologies *First usage possible between Apr 01, 2024 and Mar 31, 2026.*	EN	WS	5 CP
M-CIWVT-101136	Energy Process Engineering	DE	WS	5 CP
M-CIWVT-106880	Advanced Methods in Linear Control *First usage possible from Oct 01, 2024.*	DE	WS	6 CP
M-CIWVT-106444	Intensification of Bioprocesses	DE	SS	6 CP
M-CIWVT-106476	Food Bioprocess Engineering	DE	WS	6 CP
M-ETIT-106778	Medical Imaging Technology *First usage possible from Apr 01, 2025.*	EN	SS	6 CP
M-CIWVT-101137	Industrial Organic Chemistry	DE	WS	5 CP
M-ETIT-105874	Physiology and Anatomy for Biomedical Engineering *First usage possible from Oct 01, 2025.*	DE	WS	6 CP
M-ETIT-105703	Laboratory Course: Electrochemical Energy Technologies *First usage possible from Apr 01, 2025.*	DE/EN	SS	5 CP

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-104458	Applied Thermal Process Engineering	DE	WS	12 CP
M-CIWVT-106477	Automation and Control Systems Engineering	DE	WS	12 CP
M-CIWVT-101143	Biotechnology	DE	WS	12 CP
M-CIWVT-106825	Chemical Reaction Engineering *First usage possible from Oct 01, 2024.*	DE	WS	12 CP
M-CIWVT-101145	Energy and Environmental Engineering	DE	WS	12 CP
M-CIWVT-106700	Formulation and Characterisation of Energy Materials *First usage possible from Oct 01, 2024.*	DE	WS	12 CP
M-CIWVT-104457	Fundamentals of Refrigeration	DE	WS	12 CP
M-CIWVT-105995	Circular Economy	DE	WS	12 CP
M-CIWVT-101148	Food Technology	DE	Jährlich	12 CP
M-CIWVT-106448	Air Pollution Control	DE	WS	12 CP
M-CIWVT-101147	Mechanical Separation Technology	DE	WS	12 CP
M-CIWVT-101154	Micro Process Engineering	DE	WS	12 CP
M-CIWVT-101153	Process Development and Scale-up	DE	WS	12 CP
M-CIWVT-107495	Introduction to Thin Film Technology *First usage possible from Oct 01, 2025.*	DE	WS	12 CP

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.

Registration in the Campusmanagement System

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

Mandatory				
M-CIWVT-106438	Programming and Numeric Simulation	DE	SS	3 CP
M-HOC-106502	Scientific Writing with LaTeX	DE	WS	2 CP

3.9 Additional Examinations

Additional Examinations (Election: at most 30 credits)				
M-CIWVT-102017	Further Examinations	DE	WS+SS	30 CP
M-FORUM-106753	Supplementary Studies on Science, Technology and Society *First usage possible from Oct 01, 2024.*	DE	WS+SS	16 CP

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	DE	WS+SS	30 CP

Modelled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in your study program.

4 Modules

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

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	1

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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

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

Credits	Grading	Duration	Language	Level	Version
7 CP	graded	1 term	German	3	3

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

Assessment
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]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each summer term	1 term	German	3	2

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

Assessment
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

Recommendations
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]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each winter term	1 term	German	3	2

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

Assessment
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

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

Literature
will be announced in class.

M 4.5 Module: Advanced Methods in Linear Control [M-CIWVT-106880]

Coordinators: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 10/1/2024)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	2 terms	German	4	1

Mandatory			
T-CIWVT-113088	Automation and Control Systems Engineering - Exam	6 CP	Meurer

Assessment
Learning control is an oral exam lasting approx. 30 minutes.

Prerequisites
None.

Module Grade Calculation
The module grade is the grade of the oral exam.

M 4.6 Module: Air Pollution Control [M-CIWVT-106448]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	1

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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 4.7 Module: Applied Apparatus Engineering [M-CIWVT-103297]

Coordinators: Dr. Martin Neuberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 4/1/2025)

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-CIWVT-106562	Applied Apparatus Engineering	5 CP	Neuberger

Assessment
Success Control is an written examination of 90 minutes duration according to § 4 Abs. 2 Nr. 1 SPO.

Prerequisites
None

Competence Goal
The students will be able to describe the necessary steps for concept, planning and calculation of a construction of a machine until the commissioning. This contains the choice and declaration of single components. The students will apply the principles of the machine design with respect to the requirements for different educts, products and processes.

Additionally to technical aspects, the students will learn about cost management, time management and quality management. The students will know the sequence of licensing and providing procedures.

Content
Project Management
Project time management, project cost management, work breakdown structure

Process of Machine Design
Product (requirements with respect to corrosion, purity, cleanness …), process (manufacturing, pressure, temperature, …), selection of materials and components (motors, pumps, vans, fittings), maintenance, repair, safety, manufacturing process (welding, brazing …), transport, commissioning, performance test, approval …

Procurement
Technical specification, call for tenders, contract design, claim management

Quality Management
Certification concerning ISO 9001:2015, quality planning, quality approval
e.g. welding process qualification, qualified welders ...
material qualification report, control of manufacturing and mounting, commissioning

Workload
Attendance time: 60 h
Self-study: 45 h
Exam preparation: 45 h

Literature
Walter Wagner: Planung im Anlagenbau; Vogel Business Media; Auflage: 3. Auflage (August 2009)

M 4.8 Module: Applied Thermal Process Engineering [M-CIWVT-104458]

Coordinators: Dr.-Ing. Benjamin Dietrich
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	3	4

Mandatory			
T-CIWVT-109120	Applied Thermal Process Engineering - Project Work	6 CP	Dietrich
T-CIWVT-110803	Applied Thermal Process Engineering - Exercises	6 CP	Dietrich

Assessment
The learning control consists of two module components:

- Exercises and lab (winter semester)
- Project work and presentation (summer semester)

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

Competence Goal
Students can

- explain basic, future-oriented processes of applied thermal process engineering
- process chain of a scientific question up to its answer: planning, conceptual design, implementation, execution and evaluation of fundamental experiments, describing aspects for implementation on a technical scale (scale-up)
- work scientifically using standard IT tools
- present scientific results
- independently acquire specialist knowledge

Content
Within the scope of this module an insight into the current research of the institute is to be made possible, which deals with future-oriented topics, such as renewable energy concepts, electromobility and energy storage. Three basic experiments in the fields of drying, heat transfer and crystallization are offered in the form of a project work.

First, the corresponding technical and methodological fundamentals are presented in a lecture. This also includes the transfer of necessary knowledge for the preparation of a scientific report or a scientific presentation as well as the use of special Excel tools such as solvers or macros. In special workshops at the TVT the lecture contents can be trained. Subsequently, experiments are carried out in the laboratory using modern, partly self-assembled measuring technology (e.g. temperature sensors based on single board computers / Arduino) on the respective topic. The evaluation is carried out using the basics laid down in the lecture and with the aid of corresponding chapters of the VDI heat atlas. The results are summarized in a work report. In the following step, a design calculation for the industrial scale-up with corresponding specifications of the required devices is prepared for one of the basic experiments. The design achieved is to be presented to the other students of the profile subject in a scientific seminar. The practical part is rounded off by an excursion to BASF in Ludwigshafen, which provides insights into the application of what has been learned in industrial implementation.

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

Workload
Lectures and exercises: 100 h

Homework: 160 h

Labooratory work (incl. interpretation and report): 100 h

Recommendations
The successful participation in the lecture "Basics of Heat an Mass Transfer" of the TVT ist an advantage.

Literature

- VDI-Wärmeatlas, Springer 2013
- Own Mauscripts

M 4.9 Module: Basic Practical Course in Natural Sciences [M-CIWVT-106427]

Coordinators: 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	Recurrence	Duration	Language	Level	Version
4 CP	pass/fail	Each winter term	1 term	German	3	1

Mandatory			
T-CIWVT-113015	Laboratory Work: General Chemistry	2 CP	Horn, West
T-CIWVT-113014	Laboratory Work: Microbiology for Engineers	2 CP	Neumann

Assessment
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

Additional Information
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 4.10 Module: Biology for Engineers [M-CIWVT-106414]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each winter term	2 terms	German	3	1

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

Assessment
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)

Recommendations
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 4.11 Module: Biopharmaceutical Process Engineering [M-CIWVT-106437]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each summer term	1 term	German	4	1

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

Assessment
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 4.12 Module: Biopharmaceutical Process Engineering [M-CIWVT-106475]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German	4	1

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

Assessment
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 4.13 Module: Bioprocess Development [M-CIWVT-107403]

Coordinators: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-CIWVT-114538	Bioprocess Development	6 CP	

Assessment
Learning control ist an wirtten exam lastring 120 minutes.

Prerequisites
None.

Competence Goal
Subject-specific and methodological competencies:

The students

- Know the fundamental steps involved in developing a bioprocess, from concept to implementation.
- Understand and apply fundamental methods relevant to each stage of bioprocess development.
- Recognize how successive steps in bioprocess development are interconnected and how changes in one stage affect others.
- Be aware of the complexity and multidisciplinary nature of bioprocess development, integrating knowledge from biology, chemistry, engineering, and business.
- Learn to theoretically design a new bioprocess from scratch, considering all relevant constraints.
- Evaluate and mitigate critical steps and risks during bioprocess development.
- Develop bioprocesses with the end in mind, taking into account market requirements, cost efficiency, and sustainability.
- Stay informed about emerging trends, new methods, and technologies in the field, including the impact of artificial intelligence on future bioprocess development.

Social and self-competence:

The students

- Identify and summarize key elements and constraints of complex bioprocesses
- Developed effective communication skills to successfully work with experts from different disciplines involved in bioprocess development.
- Engaged in independent learning to continuously expand knowledge and adapt to new challenges in the field.
- Developed critical thinking, creativity and problem-solving skills necessary for developing fundamentally new processes and solutions
- Developed potential solutions and consider options for the development of a bioprocess

Content
Successful bioprocess development requires a range of technical and communication skills. The course will link microbial strain engineering with bioprocess engineering and connects the basic bioengineering knowledge gained in the first years of studies. Knowledge of previous courses will be reinforced and applied for the technical development of bioprocesses. Central guidelines and concepts to develop robust, economic and sustainable bioprocesses will be introduced. The objective of this course is to provide the students with the necessary and fundamental insight into bioprocess development and how different fields interact with each other. This includes (i) defining the product and (ii) the choice of raw material (ii), microbial host selection (iii), strain engineering (iv), bioprocess optimization (v), and scale-up and operation of the bioprocess (vi). State of the art knowledge will be supported by insights into emerging fields and topics within bioprocess development such as miniaturization, automatization, digitalization that will accelerate bioprocess development in future. The students will learn to think interdisciplinary and to apply the key principles of the different bioprocess development steps to develop future bioprocesses.

Teaching formats include a combination of lectures, exercises and case studies. Lecture topics include:

1. Bioprocess development workflow and guidelines
2. Substrate and host selection
3. Strain engineering and screening
4. Bioprocess optimization
5. Bioprocess-scale-up
6. Cost and sustainability estimation
7. Case studies
8. Regulatory and quality control requirements
9. Digitalisation and artificial intelligence

Module Grade Calculation
The module grade is the grade of the written exam.

Workload

- Attendance time: Lectures and exercieses 60 hrs
- Homework: Wrap-up and preperation of lectures and exercies: 80 hrs
- Exam preparation: 40 hrs

Recommendations
Bioprocess Engineering.

Literature

- Lecture scripts
- Pauline M. Doran, Bioprocess Engineering Principles, Academic Press; 2nd edition, ISBN: 012220851X
- Winfried Storhas, Bioverfahrensentwicklung, Wiley-VCH, 2. Aufl. 2014, ISBN: 978-3-527-32542-5

M 4.14 Module: Bioprocess Development [M-CIWVT-107406]

Coordinators: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Bioprocess Engineering)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-CIWVT-114538	Bioprocess Development	6 CP	
T-CIWVT-114542	Laboratory Work: Bioprocess Development	3 CP	Grünberger

Assessment
Learning consists of

- Wirtten exam lastring 120 minutes.
- Examination of another typ: Lab course.

Prerequisites
None.

Competence Goal
Subject-specific and methodological competencies:

The students

- Know the fundamental steps involved in developing a bioprocess, from concept to implementation.
- Understand and apply fundamental methods relevant to each stage of bioprocess development.
- Recognize how successive steps in bioprocess development are interconnected and how changes in one stage affect others.
- Be aware of the complexity and multidisciplinary nature of bioprocess development, integrating knowledge from biology, chemistry, engineering, and business.
- Learn to theoretically design a new bioprocess from scratch, considering all relevant constraints.
- Evaluate and mitigate critical steps and risks during bioprocess development.
- Develop bioprocesses with the end in mind, taking into account market requirements, cost efficiency, and sustainability.
- Stay informed about emerging trends, new methods, and technologies in the field, including the impact of artificial intelligence on future bioprocess development.

Social and self-competence:

The students

- Identify and summarize key elements and constraints of complex bioprocesses
- Developed effective communication skills to successfully work with experts from different disciplines involved in bioprocess development.
- Engaged in independent learning to continuously expand knowledge and adapt to new challenges in the field.
- Developed critical thinking, creativity and problem-solving skills necessary for developing fundamentally new processes and solutions
- Developed potential solutions and consider options for the development of a bioprocess

Lab Course:

- are able to independently model and simulate biotechnological processes.
- are able to create flow diagrams, select and interconnect process modules and calculate material and energy balances.
- understand the basics of cost estimation and can calculate investment and operating costs for bioprocesses with SuperPro Designer.
- are able to evaluate process alternatives from a technical, economic and ecological point of view and identify optimization potential.
- are able to critically interpret the results and use them for the development and scale-up of biotechnological processes

Content
Successful bioprocess development requires a range of technical and communication skills. The course will link microbial strain engineering with bioprocess engineering and connects the basic bioengineering knowledge gained in the first years of studies. Knowledge of previous courses will be reinforced and applied for the technical development of bioprocesses. Central guidelines and concepts to develop robust, economic and sustainable bioprocesses will be introduced. The objective of this course is to provide the students with the necessary and fundamental insight into bioprocess development and how different fields interact with each other. This includes (i) defining the product and (ii) the choice of raw material (ii), microbial host selection (iii), strain engineering (iv), bioprocess optimization (v), and scale-up and operation of the bioprocess (vi). State of the art knowledge will be supported by insights into emerging fields and topics within bioprocess development such as miniaturization, automatization, digitalization that will accelerate bioprocess development in future. The students will learn to think interdisciplinary and to apply the key principles of the different bioprocess development steps to develop future bioprocesses.

Teaching formats include a combination of lectures, exercises and case studies. Lecture topics include:

1. Bioprocess development workflow and guidelines
2. Substrate and host selection
3. Strain engineering and screening
4. Bioprocess optimization
5. Bioprocess-scale-up
6. Cost and sustainability estimation
7. Case studies
8. Regulatory and quality control requirements
9. Digitalisation and artificial intelligence

Lab Course:

- Introduction to planning, modeling and optimization of bioprocesses on the computer (using SuperPro Designer)
- Design of selected overall processes
- Techno-economic and (ecological) evaluation of processes

Module Grade Calculation
ECTS-weighet mean of written examination and lab work.

Workload

- Attendance time: Lectures and exercieses 60 hrs
- Homework: Wrap-up and preperation of lectures and exercies: 80 hrs
- Exam preparation: 40 hrs
- Lab course: 90 hrs

Recommendations
Bioprocess Engineering.

Literature

- Lecture scripts
- Pauline M. Doran, Bioprocess Engineering Principles, Academic Press; 2nd edition, ISBN: 012220851X
- Winfried Storhas, Bioverfahrensentwicklung, Wiley-VCH, 2. Aufl. 2014, ISBN: 978-3-527-32542-5

M 4.15 Module: Bioprocess Engineering [M-CIWVT-106434]

Coordinators: 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	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	3	2

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

Assessment
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 4.16 Module: Biotechnology [M-CIWVT-101143]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	4

Mandatory			
T-CIWVT-103668	Biotechnology	3 CP	Henke
T-CIWVT-103669	Biotechnology	9 CP	Perner-Nochta

Assessment
The module comprises two graded learning controls:

1. written examination lastin 90 minutes.
2. practical work/ protocol/ presentation

- project plan
- project work
- poster presentation/ talk
- report

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You have to fulfill one of 8 conditions:
    1. The module Dictionary Error: Id module.0x382CC4BF1B23294C934FD4756C815CA9 in category mhbplus not found. - Dictionary Error: Id module.0x382CC4BF1B23294C934FD4756C815CA9 in category mhbplus not found. must have been passed.
    2. The module Dictionary Error: Id module.0x99E432C44626924F8A9AED137292D27D in category mhbplus not found. - Dictionary Error: Id module.0x99E432C44626924F8A9AED137292D27D in category mhbplus not found. must have been passed.
    3. The module Dictionary Error: Id module.0xEE633ED1DA92794B9973CB21C4D7D7FD in category mhbplus not found. - Dictionary Error: Id module.0xEE633ED1DA92794B9973CB21C4D7D7FD in category mhbplus not found. must have been passed.
    4. The module Dictionary Error: Id module.0xCC15775F35D1E643BFD82A40B0DDB3BA in category mhbplus not found. - Dictionary Error: Id module.0xCC15775F35D1E643BFD82A40B0DDB3BA in category mhbplus not found. must have been passed.
    5. The module M-CHEMBIO-101115 - Organic Chemistry for Engineers must have been passed.
    6. The module component Dictionary Error: Id brick.0xE282F555AF744740838407BEDDC7FCCB in category mhbplus not found. - Dictionary Error: Id brick.0xE282F555AF744740838407BEDDC7FCCB in category mhbplus not found. must have been passed.
    7. The module M-CIWVT-106427 - Basic Practical Course in Natural Sciences must have been passed.
    8. The module Dictionary Error: Id module.0x432CFF22C44745BA88AFC2636B8021E3 in category mhbplus not found. - Dictionary Error: Id module.0x432CFF22C44745BA88AFC2636B8021E3 in category mhbplus not found. must have been passed.
2. You need to have earned at least 60 credits in your study program.

Competence Goal
Basic understanding of processes and synthesis of processes in biotechnologic production

lecture Bioanalytics:

The students can describe the selection and implementation of methods for the analysis of biomolecules. Students will be able to evaluate the advantages and limitations of the various methods with regard to their areas of application in biotechnological research in the context of various biomolecules (in particular DNA, RNA, proteins/enzymes, metabolites). Students are able to select suitable methods and experimental designs for their own (future) work in the context of qualitative and quantitative bioanalytics.

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 can prepare a (scientific) poster and present it.

Project Work:
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
lecture Bioanalytics:

The lecture will introduce the most important methods for the analysis of biomolecules. According to the genetic information flow in the cell, methods of bioanalysis for DNA, RNA, proteins/enzymes and metabolites are taught. The theory and application of methods are illustrated using research examples. Methods focus on sequencing technologies, protein analysis, enzymology, chromatographic methods and the basics of mass spectrometry and NMR. Other microscopy methods and reporter systems for analyzing biomolecules in whole cells are also presented.

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

Procect Work:
Accomplishment of autonomous investigation and practical work in the field of biotechnology, preparation of a project report

Module Grade Calculation
weighted mean based on LP.

Workload
Bioanalytics:

- Lectures and Exercises: 30 h
- Homework: 30 h
- Exam Preparation: 30 h

Management of scientific projects:

- Lectures and Exercises: 45 h
- Homework: 45 h

Lab Work:

- Lab: 80 h
- Homework: 10 h

Project:

- Lab: 10 h
- Homework: 80 h

Literature
Will be announced.

M 4.17 Module: Chemical Process Engineering [M-CIWVT-101133]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

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

Assessment
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

Recommendations
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 4.18 Module: Chemical Reaction Engineering [M-CIWVT-106825]

Coordinators: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work (Usage from 10/1/2024)

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	2

Mandatory			
T-CIWVT-113695	Chemical Reaction Engineering - Exam	6 CP	Wehinger
T-CIWVT-113696	Chemical Reaction Engineering - Project Work	6 CP	

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

M 4.19 Module: Circular Economy [M-CIWVT-105995]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	2

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	3	1

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

Assessment
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 4.21 Module: Data Analysis [M-CIWVT-106432]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each winter term	1 term	German	3	1

Mandatory			
T-CIWVT-113039	Data Analysis	3 CP	Guthausen

Prerequisites
None

M 4.22 Module: Design of Machines [M-CIWVT-101941]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each summer term	1 term	German	3	1

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

Assessment
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

Recommendations
Moduls of the 1st semester.

M 4.23 Module: Electrochemical Energy Technologies [M-ETIT-105690]

Coordinators: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage between 4/1/2024 and 3/31/2026)

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	English	4	1

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

Assessment
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 4.24 Module: Energy and Environmental Engineering [M-CIWVT-101145]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	4

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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

Recommendations
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 4.25 Module: Energy Process Engineering [M-CIWVT-101136]

Coordinators: Dr. Frederik Scheiff
Prof. Dr. Oliver Thomas Stein

Organisation: KIT Department of Chemical and Process Engineering

Part of: Specialization/ Process Engineering (Specialization Process Engineering)

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-CIWVT-101889	Energy Process Engineering	5 CP	Scheiff, Stein

Assessment
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

Recommendations
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 4.26 Module: Engineering Mechanics: Dynamics [M-CIWVT-101128]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	3	2

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

Assessment
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

Recommendations
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 4.27 Module: Engineering Mechanics: Statics [M-CIWVT-105846]

Coordinators: Prof. Dr. Norbert Willenbacher
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	3	1

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

M 4.28 Module: Fluiddynamics [M-CIWVT-101131]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	2

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

Assessment
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

Recommendations
Courses of 1st - 3rd semester

Literature
Nirschl, Zarzalis: Skriptum Fluidmechanik

Zierep: Grundzüge der Strömungslehre, Teubner 2008

Prandtl: Führer durch die Strömungslehre, Teubner 2008

M 4.29 Module: Food Bioprocess Engineering [M-CIWVT-106476]

Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Process Engineering)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-CIWVT-113021	Food Bioprocess Engineering	6 CP	Leister

Assessment
Learning control is a written examination lasting approx. 120 minutes.

Prerequisites
None.

Competence Goal
Lecture:

Students will be able to describe the basics of microbial spoilage and the possibilities for preserving food and life science products. They will be able to analyze the suitability of different preservation methods for different products and assign their respective advantages and disadvantages. In addition, students can name biotechnologically produced foods and describe the corresponding processes and the equipment used. Using application examples from food bioprocess engineering, they can demonstrate, discuss and debate the special features of process control.

Exercise:

Students are able to carry out calculations for process design independently for selected applications and to use the necessary tools methodically and appropriately.

Content
The students learn

- which microorganisms are important for the safety and production of food and life science products.
- technical possibilities to ensure the safety of food.
- about selected historical biotechnological processes for food production and their modern technological implementation options.
- to understand the approach of a food engineer in product and process development based on current case studies.
- the calculation principles for technical process design.
- know product-oriented application examples.

Module Grade Calculation
The module grade is the grade of the written exam.

Workload

- Attendance time/ lectures and exercises: 60 hrs
- homework - wrap-up of lectures and exercises: 80 hrs
- exam preparation: 40 hrs

Literature

- Vorlesungsfolien, Skripte mit Übungsfragen, FAQ zum Vorlesungsstoff
- 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)

M 4.30 Module: Food Bioprocess Engineering [M-CIWVT-106436]

Coordinators: Dr.-Ing. Nico Leister
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Process Engineering (Specialization Bioprocess Engineering)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-CIWVT-113021	Food Bioprocess Engineering	6 CP	Leister
T-CIWVT-113022	Food Bioprocess Engineering Lab	3 CP	Leister

Assessment
The Module comprises two learning controls:

1. written examination, duration 120 minutes

2. Lab

Prerequisites
None.

Competence Goal
Lecture:

Students will be able to describe the basics of microbial spoilage and the possibilities for preserving food and life science products. They will be able to analyze the suitability of different preservation methods for different products and assign their respective advantages and disadvantages. In addition, students can name biotechnologically produced foods and describe the corresponding processes and the equipment used. Using application examples from food bioprocess engineering, they can demonstrate, discuss and debate the special features of process control.

Exercise:

Students are able to carry out calculations for process design independently for selected applications and to use the necessary tools methodically and appropriately.

Practical course:

Students will be able to produce biotechnologically manufactured foodstuffs themselves on a laboratory scale and document the procedure in a scientifically and formally correct manner. They will be able to predict the influence of changes in process and recipe parameters, measure them and discuss the results critically.

to secure food (and life science product) safety.

Content

- which microorganisms are important for the safety and production of food and life science products.
- technical possibilities to ensure the safety of food.
- about selected historical biotechnological processes for food production and their modern technological implementation options.
- to understand the approach of a food engineer in product and process development based on current case studies.
- the calculation principles for technical process design.
- to know product-oriented application examples.
- carry out small research studies in food product design.

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

Workload
lectures and exercises, written exam:

- Attendance time/ lectures and exercises: 60 hrs
- homework - wrap-up of lectures and exercises: 80 hrs
- exam preparation: 40 hrs

Lab-Course: One week

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

Literature

- Lecuture slides, scripts with exercies queistions, FAQ on the lecture material
- 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)

M 4.31 Module: Food Technology [M-CIWVT-101148]

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

Credits	Grading	Duration	Language	Level	Version
12 CP	graded	2 terms	German	4	5

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

Assessment
The learning control consists of two partial achievements:

1. Oral examination (in the group) lasting approx. 45 minutes
2. Project work (presentation and report of results)

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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 2 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 4.32 Module: Formulation and Characterisation of Energy Materials [M-CIWVT-106700]

Coordinators: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Specialization/ Project Work (Usage from 10/1/2024)

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	1

Mandatory			
T-CIWVT-113478	Formulation and Characterisation of Energy Materials - Exam	8 CP	Oelschlaeger
T-CIWVT-113479	Formulation and Characterisation of Energy Materials - Project Work	4 CP	Oelschlaeger

Assessment
The learning control consists of two partial achievements:

1. project work (teamwise)
2. oral examinations (courses)

The oral examinations have to be passed as a precondition for project work

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

Competence Goal
Basic knowledge about the design of complex fluids based on dispersions or emulsions by chemical engineering processes. Fundamental comprehension of applications and working properties, flow behavior and colloidal stability of disperse systems. Applying this knowledge in context of their project work. They gather experience in teamoriented problem solving.

Content
Representation of a systematic of the relation between the quality aspects of products and their physico-chemical properties. Furthermore, these properties are generated in the respective production processes. This systematics is fundamentally presented in the lecture "Fabrication and rheological characterization of energy materials".The application of this systematics is practiced on specific case studies.

M 4.33 Module: Fundamentals of Heat and Mass Transfer [M-CIWVT-101132]

Coordinators: Dr.-Ing. Benjamin Dietrich
Prof. Dr.-Ing. Thomas Wetzel
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Scientific Engineering

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each summer term	1 term	German	3	2

Mandatory			
T-CIWVT-101883	Fundamentals of Heat and Mass Transfer	7 CP	Dietrich, Wetzel

Assessment
Learning control is a written examination lasting 180 minutes.

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

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

Literature
v. Boeckh, Wetzel: Wärmeübertragung, Springer 2009

M 4.34 Module: Fundamentals of Refrigeration [M-CIWVT-104457]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	3	4

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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

Recommendations
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 4.35 Module: Further Examinations [M-CIWVT-102017]

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

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

Prerequisites
None

M 4.36 Module: General Chemistry and Chemistry of Aqueous Solutions [M-CIWVT-106431]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	3	1

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

Assessment
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 4.37 Module: Industrial Organic Chemistry [M-CIWVT-101137]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	3	1

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

Assessment
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 4.38 Module: Intensification of Bioprocesses [M-CIWVT-106444]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German	4	1

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

Assessment
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

Recommendations
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 4.39 Module: Intensification of Bioprocesses [M-CIWVT-106416]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each summer term	1 term	German	4	1

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

Assessment
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

Recommendations
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 4.40 Module: Introduction into Bioengineering [M-CIWVT-106433]

Coordinators: 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	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	3	1

Mandatory			
T-CIWVT-113018	Introduction into Bioengineering	5 CP	Grünberger, Holtmann, Hubbuch, van der Schaaf

M 4.41 Module: Introduction to Thin Film Technology [M-CIWVT-107495]

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: Specialization/ Project Work (Usage from 10/1/2025)

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	3	1

Mandatory			
T-CIWVT-114692	Introduction to Thin Film Technology - Project Work	6 CP	Schabel, Scharfer
T-CIWVT-114693	Introduction to Thin Film Technology - Exercises and Lab	6 CP	Schabel, Scharfer

Prerequisites
60 LP, at least one lab work passed.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

Competence Goal
Students can

- explain basic, future-oriented processes of thin film technology
- explain a process chain of a scientific question up to its answer: planning, conceptual design, implementation, execution and evaluation of fundamental experiments, describing aspects for implementation on a technical scale (scale-up)
- work scientifically using standard IT tools
- present scientific results
- independently acquire specialist knowledge

Literature

- VDI-Wärmeatlas, Springer 2013
- eigene Skripte

M 4.42 Module: Laboratory Course: Electrochemical Energy Technologies [M-ETIT-105703]

Coordinators: Prof. Dr.-Ing. Ulrike Krewer
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 4/1/2025)

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German/English	3	3

Mandatory			
T-ETIT-111376	Laboratory Course: Electrochemical Energy Technologies	5 CP	Röse

Assessment
Success control takes place in the form of other types of examination. It consists of four experiments and written reports are assessed in each case. The module grade is based on the overall impression.

The successfully completed exoeriments together form an examination unit. If you fail, you have to repeat the internship in its entirety.

Prerequisites

- The prerequisite for admission to the module is that the students have successfully passed the module examination of „M-ETIT-105690 – Electrochemical Energy Technologies“. Participation in the safety briefing is mandatory.
- Participation in the safety instruction is required in the same examination period as the internship and must be completed again if the internship is repeated.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module M-ETIT-105690 - Electrochemical Energy Technologies must have been passed.

Competence Goal
The students deepen and strengthen their previously learned basic knowledge from the lecture "Electrochemical Energy Technologies". They understand how to experimentally analyze and quantitatively describe processes at interfaces under substrate conversion by charge transfer. They are able to build electrochemical cells, understand their functional principle and are able to determine electrochemical processes. Furthermore, they are able to apply electrochemical measurement methods specifically to questions that are relevant for the analysis of modern energy converters and storage technologies.

They are also able to document and evaluate measured data and to critically discuss the results. They can competently carry out error estimations and confidently master computer-assisted data evaluation.

Content
Four selected electrochemistry experiments will be carried out:

Experiment 1: Determination of transport parameters of reversible systems

- Voltammetry at a stationary electrode
- Voltammetry at a rotating disc electrode

Experiment 2: Determination of hydrogen and oxygen overvoltage

Experiment 3: Construction of a polymer electrolyte membrane fuel cell

Experiment 4: Investigation of the self-constructed PEM fuel cell under various operating conditions

Module Grade Calculation
The module grade results of the assessment of the written reports. Details will be given during the lecture.

Additional Information
Participation in the safety instruction is mandatory. Participation in the safety instruction is required in the same examination period as the internship and must be completed again if the internship is repeated.

Workload

1. attendance in laboratory practical course: 4x 5 h (block course)
2. preparation / follow-up: 30 h
3. preparation of written reports: 100 h

M 4.43 Module: Mathematical Modeling for Biochemical Engineering [M-MATH-106443]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each summer term	1 term	German	3	1

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

M 4.44 Module: Mechanical Processing [M-CIWVT-101135]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-CIWVT-101886	Mechanical Processing	6 CP	Dittler

Assessment
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

Recommendations
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 4.45 Module: Mechanical Separation Technology [M-CIWVT-101147]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	3

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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 4.46 Module: Medical Imaging Technology [M-ETIT-106778]

Coordinators: Prof. Dr.-Ing. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 4/1/2025)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	English	4	1

Mandatory			
T-ETIT-113625	Medical Imaging Technology	6 CP	Spadea

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

Prerequisites
none

Competence Goal
For each imaging modality students will be able to:

- identify required energy source;
- analyze the interactions between the form of energy and biological tissue distinguishing desired signal from noise contribution;
- critically interpret the image content to derive knowledge
- evaluate image quality and implementing strategies to improve it.

Moreover, the students will be able to communicate in technical and clinical English languange.

Content

- Basic knowledge of mathematical and physical principles of medical imaging formation, including X-ray based modalities, nuclear medicine imaging, magnetic resonance imaging and ultrasound
- Components of medical imaging devices.
- Assessment of image quality in terms of signal-to-noise-ratio, presence of artifact, spatial, Spectral and temporal resolution
- Safety and protection for patients and workers.

Module Grade Calculation
The module grade is the grade of the written exam.

A bonus can be earned for voluntary tasks such as:

- presentation and discussion of a specific topic,
- participation to writing the lecture minutes
- implementation of educational tools

The exact criteria for awarding a bonus will be announced at the beginning of the lecture period. If the grade in the oral exam is between 4.0 and 1.3, the bonus improves the grade by 0.3 or 0.4.

Bonus points do not expire and are retained for any examinations taken at a later date.

Workload

1. attendance in lectures an exercises: 15*4 h = 60 h
2. preparation / follow-up: 15*6 h = 90 h
3. preparation of and attendance in examination: 30 h

A total of 180 h = 6 CR

Recommendations
Basic knowledge in the field of physics and signal processing is helpful.

M 4.47 Module: Micro Process Engineering [M-CIWVT-101154]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	3

Mandatory			
T-CIWVT-103666	Micro Process Engineering	7 CP	Pfeifer
T-CIWVT-103667	Micro Process Engineering	5 CP	Dittmeyer, Pfeifer

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each term	1 term	German	3	1

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

Prerequisites
None

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in your study program.

M 4.49 Module: Organic Chemistry for Engineers [M-CHEMBIO-101115]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	3	1

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

Assessment
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 4.50 Module: Orientation Exam [M-CIWVT-106447]

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

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

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

Modeled Deadline
This module must be passed until the end of the **3. semester**.

Prerequisites
None

M 4.51 Module: Physiology and Anatomy for Biomedical Engineering [M-ETIT-105874]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Specialization/ Process Engineering (Specialization Process Engineering) (Usage from 10/1/2025)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	2 terms	German	3	2

Mandatory			
T-ETIT-111815	Physiology and Anatomy for Biomedical Engineering	6 CP	Nahm

Assessment
The exmaniation is carried out in the form of a written test of 120 minutes.

The examination includes the contents of Physiologie und Anatomie I (offered every winter term) and Physiologie und Anatomie II (offered every summer term).

Prerequisites
The modules "M-ETIT-100390 - Physiologie und Anatomie I" and "M-ETIT-100391 - Physiologie und Anatomie II" must not been started.

Competence Goal
After studying this module

- students will be able to describe and explain the basic structural and functional principles of the organism at various levels of organization (molecular and cellular to organ and organ system level) in order to classify the organism in its environment,
- have the ability to apply this knowledge to explain higher-level organ and organ system functions,
- know advanced mathematical, scientific and engineering methods for describing physiological processes and are able to apply them,
- be able to describe the functional relationships at the organ and organ system level from a diagnostic and therapeutic perspective and derive the requirements for medical technology systems from this
- and can identify the sources of biosignals and derive connections between physiological parameters and physical measured variables.

Sustainability competence objective: The students have actively shaped their learning process.

Content
Physiologie und Anatomie I (winter semester)

This course provides basic knowledge of the major human organ systems and medical terminology. It is intended for students of technical courses who are interested in physiological issues.

Topic blocks:

- Organizational levels of the organism
- Building blocks of life
  - Proteins
  - Lipids
  - Carbohydrates
  - Lipids
  - Nuleic acids
- Cells
  - Structure
  - Membrane transport processes
  - Protein biosynthesis
  - Cell respiration
  - Nerve cells
  - Muscle cells
- Tissue
  - Tissue types
  - Cell connections
- Sensory organs
  - Eye
  - Hearing

Physiologie und Anatomie II (summer term)

This course expands on the knowledge taught in the first part of the course and introduces additional human organ systems.

Topic blocks:

- The nervous system
  - Anatomy and functional structure
- The cardiovascular system
  - Anatomy and function of the heart
  - Vascular system and blood pressure
- The respiratory system
  - Anatomy and ventilation
  - Gas transport
- The digestive system
  - Anatomy
  - Physiology of digestion
- The endocrine system
  - Endocrine organs
  - Hormonal signal transduction
- Acid-base balance
- Water-electrolyte balance
- Thermoregulation

Module Grade Calculation
The module grade is the grade of the written exam.

Bonus points can be awarded for a student contribution to the lecture.

- The student contribution consists of the formulation of learning objectives and questions to check the learning objectives for the lecture units. The corresponding lecture units are made available for selection in ILIAS.
- The students create the student contributions in small groups. They submit their contribution in the form of a PowerPoint presentation in ILIAS by the specified deadline.
- The presentation will be corrected and approved by the lecturer or course tutor if necessary.
- The contribution will be presented by the group in the following lecture unit within the specified period and discussed with the plenum. If necessary, the presenting group takes on board the feedback and creates a revised vision. The final version of the contribution is made available to all lecture participants in ILIAS for exam preparation.
- Bonus points are awarded by the lecturer on the basis of the written paper and the presentation in the plenary session.
- Each participant can earn a maximum of 6 bonus points. Bonus points can only be earned once.
- Participation in the student contributions is voluntary.

The bonus points are credited as follows:

- A maximum of 6 points can be credited to the exam result for the bonus task passed.
- The grade can thus be improved by a maximum of one grade step.
- The total number of points remains limited to 120 points. The bonus points are only taken into account if the exam is passed. Bonus points do not expire and are retained for any examinations taken at a later date.

Additional Information
This module is part of the Orientation Exam of SPO BSc Medizintechnik § 8. The examination must be taken by the end of the 2nd semester. A repeat examination must be taken by the end of the 3rd semester.

Workload
The workload includes:

- Attendance time in lectures (2 h, 30 appointments each) = 60 h
- Self-study (3 h, 30 appointments each) = 90 h
- Preparation / post-processing = 30 h

Total effort approx. 180 hours = 6 LP

Teaching and Learning Methods
Winter/summer term:

- WT: Physiologie und Anatomie I
- ST: Physiologie und Anatomie II

M 4.52 Module: Process Development and Scale-up [M-CIWVT-101153]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
12 CP	graded	Each winter term	2 terms	German	4	4

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

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in your study program.

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.

Additional Information
As part of the project study a visit to the IKFT and the bioliq plant at the Campus North is intended, as well as an excursion to an industrial company.

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

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

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

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

Prerequisites
None

Module Grade Calculation
Ungraded

M 4.54 Module: Scientific Writing with LaTeX [M-HOC-106502]

Organisation:

Part of: Interdisciplinary Qualifications

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

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

M 4.55 Module: Single Results [M-CIWVT-101991]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	pass/fail	Each term	1 term	German	3	6

Master Transfer Examinations (Election: at least 30 credits)			
T-CIWVT-114498	Process and Plant Design in Biotechnology - Seminar	2 CP	Holtmann
T-CIWVT-114499	Process and Plant Design in Biotechnology - Written Exam	4 CP	Holtmann
T-CIWVT-114497	Thermodynamics for Bioengineering	6 CP	Enders, Zeiner
T-CIWVT-106029	Biopharmaceutical Purification Processes	6 CP	Hubbuch
T-CIWVT-106032	Kinetics and Catalysis	6 CP	Wehinger
T-CIWVT-113235	Excercises: Membrane Technologies	1 CP	Horn, Saravia
T-CIWVT-113236	Membrane Technologies in Water Treatment	5 CP	Horn, Saravia
T-CIWVT-106035	Computational Fluid Dynamics	6 CP	Nirschl
T-CIWVT-106028	Particle Technology Exam	6 CP	Dittler
T-CIWVT-114107	Thermal Process Engineering II	6 CP	Zeiner
T-CIWVT-106036	Internship	14 CP	Bajohr

Prerequisites
None

M 4.56 Module: Supplementary Studies on Science, Technology and Society [M-FORUM-106753]

Coordinators: Dr. Christine Mielke
Christine Myglas
Organisation: General Studies. Forum Science and Society (FORUM)
Part of: Additional Examinations (Usage from 10/1/2024)

Credits	Grading	Recurrence	Duration	Language	Level	Version
16 CP	graded	Each term	3 terms	German	3	1

Election Notes
Students have to self-record the achievements obtained in the Supplementary Studies on Science, Technology and Society in their study plan. FORUM (formerly ZAK) records the achievements as "non-assigned" under "ÜQ/SQ-Leistungen". Further instructions on self-recording of achievements can be found in the FAQ at https://campus.studium.kit.edu/ and on the FORUM homepage at https://www.forum.kit.edu/english/. The title of the examination and the amount of credits override the modules placeholders.

If you want to use FORUM achievements for both your Interdisciplinary Qualifications and for the Supplementary Studies, please record them in the Interdisciplinary Qualifications first. You can then get in contact with the FORUM study services (stg@forum.kit.edu) to also record them in your Supplementary Studies.

In the Advanced Unit you can choose examinations from three subject areas: "About Knowledge and Science", "Science in Society" and "Science in Social Debates". It is advised to complete courses from each of the three subject areas in the Advanced Unit.

To self-record achievements in the Advanced Unit, you have to select a free placeholder partial examination first. The placeholders' title do *not* affect which achievements the placeholder can be used for!

Mandatory			
T-FORUM-113578	Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration	2 CP	Mielke, Myglas
T-FORUM-113579	Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration	2 CP	Mielke, Myglas
Advanced Unit Supplementary Studies on Science, Technology and Society (Election: at least 12 credits)			
T-FORUM-113580	Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration	3 CP	Mielke, Myglas
T-FORUM-113581	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration	3 CP	Mielke, Myglas
T-FORUM-113582	Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration	3 CP	Mielke, Myglas
Mandatory			
T-FORUM-113587	Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society	0 CP	Mielke, Myglas

Assessment
The monitoring is explained in the respective partial achievement.

They are composed of:
- Protocols
- Reflection reports
- Presentations
- Preparation of a project work
- An individual term paper
- An oral examination
- A written exam

Upon successful completion of the supplementary studies, graduates receive a graded report and a certificate issued by the FORUM.

Prerequisites
The course is offered during the course of study and does not have to be completed within a defined period. Enrollment is required for all assessments of the modules in the supplementary studies.
Participation in the supplementary studies is regulated by § 3 of the statutes. KIT students register for the supplementary studies by selecting this module in the student portal and booking a performance themselves. Registration for courses, assessments, and exams is regulated by § 8 of the statutes and is usually possible shortly before the start of the semester.
The course catalog, module description (module manual), statutes (study regulations), and guidelines for creating the various written performance requirements can be downloaded from the FORUM homepage at https://www.forum.kit.edu/begleitstudium-wtg.php.

Registration and exam modalities
PLEASE NOTE:
Registration on the FORUM, i.e. additionally via the module selection in the student portal, enables students to receive up-to-date information about courses or study modalities. In addition, registering on the FORUM ensures that you have proof of the credits you have earned. As it is currently (as of winter semester 24-25) not yet possible to continue additional credits acquired in the Bachelor's programme electronically in the Master's programme, we strongly advise you to digitally secure the credits you have earned by archiving the Bachelor's transcript of records yourself and by registering on FORUM.
In the event that a transcript of records of the Bachelor's certificate is no longer available - we can only assign the achievements of registered students and thus take them into account when issuing the certificate.

Competence Goal
Graduates of the Supplementary Studies on Science, Technology, and Society gain a solid foundation in understanding the interplay between science, the public, business, and politics. They develop practical skills essential for careers in media, political consulting, or research management. The program prepares them to foster innovation, influence social processes, and engage in dialogue with political and societal entities. Participants are introduced to interdisciplinary perspectives, encompassing social sciences and humanities, to enhance their understanding of science, technology, and society. The teaching objectives of this supplementary degree program include equipping participants with both subject-specific knowledge and insights from epistemological, economic, social, cultural, and psychological perspectives on scientific knowledge and its application in various sectors. Students are trained to critically assess and balance the implications of their actions at the intersection of science and society. This training prepares them for roles as students, researchers, future decision-makers, and active members of society.

Through the program, participants learn to contextualize in-depth content within broader frameworks, independently analyze and evaluate selected course materials, and communicate their findings effectively in both written and oral formats. Graduates are adept at analyzing social issues and problem areas, reflecting on them critically from a socially responsible and sustainable standpoint.

Content
The Supplementary Studies on Science, Technology and Society can be started in the 1st semester of the enrolled degree programme and is not limited in time. The wide range of courses offered by FORUM makes it possible to complete the program usually within three semesters. The supplementary studies comprises 16 or more credit points (LP). It consists of **two modules: the Basic Module (4 LP) and the Advanced Module (12 LP).**

The **basic Module** comprises the compulsory courses 'Lecture Series Supplementary Studies on Science, Technology and Society' and a basic seminar with a total of 4 LP.

The **Advanced Module** comprises courses totalling 12 LP in the humanities and social sciences subject areas 'On Knowledge and Science', 'Science in Society' and 'Science in Public Debates'. The allocation of courses to the accompanying study programme can be found on the homepage https://www.forum.kit.edu/wtg-aktuelland in the printed FORUM course catalogue.

The 3 thematic subject areas:

Subject area 1: About Knowledge and Science

This is about the internal perspective of science: students explore the creation of knowledge, distinguishing between scientific and non-scientific statements (e.g., beliefs, pseudo-scientific claims, ideological statements), and examining the prerequisites, goals, and methods of knowledge generation. They investigate how researchers address their own biases, analyze the structure of scientific explanatory and forecasting models in various disciplines, and learn about the mechanisms of scientific quality assurance.

After completing courses in the "Knowledge and Science" area, students can critically reflect on the ideals and realities of contemporary science. They will be able to address questions such as: How robust is scientific knowledge? What are the capabilities and limitations of predictive models? How effective is quality assurance in science, and how can it be improved? What types of questions can science answer, and what questions remain beyond its scope?

Subject area 2: Science in Society

This focuses on the interactions between science and different areas of society, such as how scientific knowledge influences social decision-making and how social demands impact scientific research. Students learn about the specific functional logics of various societal sectors and, based on this understanding, estimate where conflicts of goals and actions might arise in transfer processes—for example, between science and business, science and politics, or science and journalism. Typical questions in this subject area include: How and under what conditions does an innovation emerge from a scientific discovery? How does scientific policy advice work? How do business and politics influence science, and when is this problematic? According to which criteria do journalists incorporate scientific findings into media reporting? Where does hostility towards science originate, and how can social trust in science be strengthened?

After completing courses in the "Sciene in Society" area, students can understand and assess the goals and constraints of actors in different societal sectors. This equips them to adopt various perspectives of communication and action partners in transfer processes and to act competently at various social interfaces with research in their professional lives.

Subject area 3: Science in Public Debates

The courses in this subject area provide insights into current debates on major social issues such as sustainability, digitalization, artificial intelligence, gender equality, social justice, and educational opportunities. Public debates on complex challenges are often polarized, leading to oversimplifications, defamation, or ideological thinking. This can hinder effective social solution-finding processes and alienate people from the political process and from science. Debates about sustainable development are particularly affected, as they involve a wide range of scientific and technological knowledge in both problem diagnosis (e.g., loss of biodiversity, climate change, resource consumption) and solution development (e.g., nature conservation, CCS, circular economy).

By attending courses in "Science in Public Debates," students are trained in an application-oriented way to engage in factual debates—exchanging arguments, addressing their own prejudices, and handling contradictory information. They learn that factual debates can often be conducted more deeply and with more nuance than is often seen in public discourse. This training enables them to handle specific factual issues in their professional lives independently of their own biases and to be open to differentiated, fact-rich arguments.

Supplementary credits:
Additional LP (supplementary work) totalling a maximum of 12 LP can also be acquired from the complementary study programme (see statutes for the WTG complementary study programme § 7). § 4 and § 5 of the statutes remain unaffected by this. These supplementary credits are not included in the overall grade of the accompanying study programme. At the request of the participant, the supplementary work will be included in the certificate of the accompanying study programme and marked as such. Supplementary coursework is listed with the grades provided for in § 9.

Module Grade Calculation
The overall grade of the supplementary course is calculated as a credit-weighted average of the grades that were achieved in the advanced module.

Additional Information
Climate change, biodiversity crisis, antibiotic resistance, artificial intelligence, carbon capture and storage, and gene editing are just a few areas where science and technology can diagnose and address numerous social and global challenges. The extent to which scientific findings are considered in politics and society depends on various factors, such as public understanding and trust, perceived opportunities and risks, and ethical, social, or legal considerations.
To enable students to use their expertise as future decision-makers in solving social and global challenges, we aim to equip them with the skills to navigate the interfaces between science, business, and politics competently and reflectively. In the Supplementary Studies, they acquire foundational knowledge about the interactions between science, technology, and society.

They learn:
- How reliable scientific knowledge is produced,
- how social expectations and demands influence scientific research, and
- how scientific knowledge is adopted, discussed, and utilized by society.

The program integrates essential insights from psychology, philosophy, economics, social sciences, and cultural studies into these topics. After completing the supplementary studies programme, students can place the content of their specialized studies within a broader social context. This prepares them, as future decision-makers, to navigate competently and reflectively at the intersections between science and various sectors of society, such as politics, business, or journalism, and to contribute effectively to innovation processes, public debates, or political decision-making.

Workload
The workload is made up of the number of hours of the individual modules:

- Basic Module approx. 120 hours
- Advanced Module approx. 360 hours
> Total: approx. 480 hours

In the form of supplementary services, up to approximately 360 hours of work can be added.

Recommendations
It is recommended to complete the supplementary study program in three or more semesters, beginning with the lecture series on science, technology, and society in the summer semester. Alternatively, you can start with the basic seminar in the winter semester and then attend the lecture series in the summer semester.

Courses in the Advanced Module can be taken simultaneously. It is also advised to complete courses from each of the three subject areas in the advanced unit.

Teaching and Learning Methods
- Lectures
- Seminars/Project Seminars
- Workshops

M 4.57 Module: Thermal Process Engineering [M-CIWVT-101134]

Coordinators: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: Fundamentals of Process Engineering (Unit Operations)

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-CIWVT-101885	Thermal Process Engineering	6 CP	Zeiner

Assessment
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

Recommendations
Courses of 1st - 4th semester

Literature
personal prints, scientific text books

M 4.58 Module: Thermodynamics I [M-CIWVT-101129]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each winter term	1 term	German	3	2

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

Assessment
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

Recommendations
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 4.59 Module: Thermodynamics II [M-CIWVT-101130]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
7 CP	graded	Each summer term	1 term	German	4	2

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

Assessment
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

Recommendations
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 Module components

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

Coordinators: Prof. Dr.-Ing. Thomas Meurer
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106477 - Automation and Control Systems Engineering
M-CIWVT-106880 - Advanced Methods in Linear Control

Type	Credits	Grading	Version
Oral examination	6 CP	graded	1

Courses					
WT 25/26	2243020	Advanced Methods in Linear Control	3 SWS	Lecture / Practice (/ 🗣	Meurer
WT 25/26	2243021	Exkursion im Profilfach Automatisierungs- und Regelungstechnik	1 SWS	Excursion (E / 🗣	Meurer
Exams					
ST 2025	7243020	Automation and Control Systems Engineering - Exam			Meurer, Jerono

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

T 5.2 Module component: Advanced Mathematics I [T-MATH-100275]

Coordinators: 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	Term offered	Version
Written examination	7 CP	graded	Each term	3

Courses					
WT 25/26	0131000	Höhere Mathematik I für die Fachrichtungen Maschinenbau, Geodäsie und Geoinformatik, Materialwissenschaft und Werkstofftechnik, und Ingenieurpädagogik	4 SWS	Lecture	Arens
WT 25/26	0131200	Höhere Mathematik I für die Fachrichtungen Chemieingenieurwesen und Verfahrenstechnik, Bioingenieurwesen, und Mechatronik und Informationstechnik	4 SWS	Lecture	Arens
Exams					
ST 2025	6700025	Advanced Mathematics I			Arens, Griesmaier, Hettlich
WT 25/26	6700007	Advanced Mathematics I			Arens, Griesmaier, Hettlich

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

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

T 5.3 Module component: Advanced Mathematics II [T-MATH-100276]

Coordinators: 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	Term offered	Version
Written examination	7 CP	graded	Each term	2

Courses					
ST 2025	0180800	Höhere Mathematik II für die Fachrichtungen Maschinenbau, Geodäsie und Geoinformatik, Materialwissenschaft und Werkstofftechnik, und Ingenieurpädagogik	4 SWS	Lecture	Arens
ST 2025	0181000	Höhere Mathematik II für die Fachrichtungen Chemieingenieurwesen und Verfahrenstechnik, Bioingenieurwesen, und Mechatronik und Informationstechnik	4 SWS	Lecture	Arens
Exams					
ST 2025	6700001	Advanced Mathematics II			Arens, Griesmaier, Hettlich
WT 25/26	6700008	Advanced Mathematics II			Arens, Griesmaier, Hettlich

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

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

T 5.4 Module component: Advanced Mathematics III [T-MATH-100277]

Coordinators: 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	Term offered	Version
Written examination	7 CP	graded	Each term	2

Courses					
WT 25/26	0131400	Höhere Mathematik III für die Fachrichtungen Maschinenbau, Materialwissenschaft und Werkstofftechnik, Chemieingenieurwesen und Verfahrenstechnik, Bioingenieurwesen, und Mechatronik und Informationstechnik	4 SWS	Lecture	Hettlich
Exams					
ST 2025	6700002	Advanced Mathematics III			Arens, Griesmaier, Hettlich
WT 25/26	6700009	Advanced Mathematics III			Arens, Griesmaier, Hettlich

Assessment
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 Prerequisites
The following conditions have to be fulfilled:

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

T 5.5 Module component: Air Pollution Control [T-CIWVT-113046]

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

Type	Credits	Grading	Term offered	Version
Oral examination	7 CP	graded	Each summer term	1

Courses					
WT 25/26	2244020	Gas Particle Measurement Technology	2 SWS	Lecture / 🗣	Dittler
WT 25/26	2244021	Exercises on 2244020 Gas Particle Measurement Technology	1 SWS	Practice / 🗣	Dittler, und Mitarbeitende
Exams					
WT 25/26	7244021	Air Pollution Control			Dittler

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

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

Prerequisites
None

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

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

Type	Credits	Grading	Version
Examination of another type	5 CP	graded	1

Courses					
ST 2025	2244022	Air Pollution Control - Project Work	2 SWS	Project (P / ✕	Dittler, und Mitarbeitende
WT 25/26	2244023	Air Pollution Control - Excursion	2 SWS	Excursion (E / 🗣	Dittler, und Mitarbeitende
Exams					
WT 25/26	7244022	Air Pollution Control - Project Thesis			Dittler

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

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

Prerequisites
None

T 5.7 Module component: Applied Apparatus Engineering [T-CIWVT-106562]

Coordinators: Dr. Martin Neuberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-103297 - Applied Apparatus Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2245830	Applied Apparatus Engineering	4 SWS	Lecture / 🗣	Neuberger
Exams					
ST 2025	7291956	Applied Machine Design			Neuberger
WT 25/26	7291956	Applied Apparatus Engineering			Neuberger

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

Assessment
Learning Control is a written examination, 90 minutes duration.

Prerequisites
None

T 5.8 Module component: Applied Thermal Process Engineering - Exercises [T-CIWVT-110803]

Coordinators: Dr.-Ing. Benjamin Dietrich
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-104458 - Applied Thermal Process Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2260310	Fundamentals of Applied Thermal Process Engineering	2 SWS	Lecture /	Dietrich, Wetzel, Zeiner
WT 25/26	2260311	Selected Chapters of Applied Thermal Process Engineering	2 SWS	Seminar /	Dietrich, Wetzel, Zeiner, und Mitarbeitende
WT 25/26	2260312	Practical Course on Applied Thermal Process Engineering (Project Work)	2 SWS	Practical course /	Dietrich, Wetzel, Zeiner, und Mitarbeitende
Exams					
WT 25/26	7280003	Applied Thermal Process Engineering - Exercises			Dietrich

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

Assessment
Learning control is an examination of another type:
The exercises (maximum 10 points) and two lab experiments (maximum 20 points) are assessed. The module component is passed if at least 15 points are achieved. Grading key on request.

Prerequisites
None

T 5.9 Module component: Applied Thermal Process Engineering - Project Work [T-CIWVT-109120]

Coordinators: Dr.-Ing. Benjamin Dietrich
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-104458 - Applied Thermal Process Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	2

Courses					
ST 2025	2260310	Grundlagen der Angewandten Thermischen Verfahrenstechnik (Profilfach)	2 SWS	Lecture / ✕	Dietrich
ST 2025	2260311	Ausgewählte Kapitel der Angewandten Thermischen Verfahrenstechnik (Profilfach)	2 SWS	Seminar / ✕	Dietrich
ST 2025	2260312	Praktikum zu Angewandte Thermische Verfahrenstechnik (Profilfach)	2 SWS	Practical course / ✕	Dietrich, und Mitarbeitende
Exams					
ST 2025	7280004	Thermal Process Engineering			Dietrich

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

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

Prerequisites
None

T 5.10 Module component: Automation and Control Systems Engineering - Project Work [T-CIWVT-113089]

Coordinators: 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	Version
Examination of another type	6 CP	graded	1

Courses					
ST 2025	2243022	Automation and Control Systems Engineering - Project Work	3 SWS	Project (P / 🗣	Meurer
WT 25/26	2243020	Advanced Methods in Linear Control	3 SWS	Lecture / Practice (/ 🗣	Meurer
WT 25/26	2243021	Exkursion im Profilfach Automatisierungs- und Regelungstechnik	1 SWS	Excursion (E / 🗣	Meurer
Exams					
WT 25/26	7243022	Automation and Control Systems Engineering - Project Work			Meurer, Jerono

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

T 5.11 Module component: 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	Version
Final Thesis	12 CP	graded	1

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

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

T 5.12 Module component: Basic Seminar Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113579]

Coordinators: Dr. Christine Mielke
Christine Myglas
Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	1

Assessment
Study achievement in the form of a presentation or a term paper or project work in the selected course.

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
It is recommended that the basic seminar be completed during the same semester as the lecture series "Science in Society". If it is not possible to attend the lecture series and the basic seminar in the same semester, the basic seminar can also be attended in the semesters before the lecture series.
However, attending courses in the advanced unit before attending the basic seminar should be avoided.

T 5.13 Module component: Biochemistry [T-CIWVT-112997]

Coordinators: PD Dr. Jens Rudat
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106414 - Biology for Engineers

Type	Credits	Grading	Term offered	Version
Written examination	2,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2212110	Biology for Engineers - Biochemistry	2 SWS	Lecture / 🗣	Rudat
Exams					
ST 2025	7212110-V-BC	Biochemistry			Rudat
WT 25/26	7212110-V-BC	BING Biochemistry			Rudat

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

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

Prerequisites
None

T 5.14 Module component: Biopharmaceutical Process Engineering [T-CIWVT-113023]

Coordinators: 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	Term offered	Version
Written examination	6 CP	graded	Each term	1

Courses					
ST 2025	2214040	Biopharmaceutical Process Engineering	3 SWS	Lecture / 🗣	Hubbuch
ST 2025	2214041	Excercises on 2241040 Biopharmaceutical Process Engineering	1 SWS	Practice / 🗣	Hubbuch, und Mitarbeiter
Exams					
ST 2025	7223001	Biopharmaceutical Process Engineering (previously Downstream Processing)			Hubbuch
WT 25/26	7214040	Biopharmaceutical Process Engineering (previously Downstream Processing)			Hubbuch

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

Workload
180 hours

T 5.15 Module component: Biopharmaceutical Purification Processes [T-CIWVT-106029]

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

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
WT 25/26	2214010	Biopharmaceutical Purification Processes	3 SWS	Lecture / 🗣	Hubbuch, Franzreb
WT 25/26	2214011	Exercises on 2214010 Biopharmaceutical Purification Processes	1 SWS	Practice / 🗣	Hubbuch, Franzreb
Exams					
ST 2025	7223011	Biopharmaceutical Purification Processes			Hubbuch
WT 25/26	7214010	Biopharmaceutical Purification Processes			Hubbuch

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

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

T 5.16 Module component: Bioprocess Development [T-CIWVT-114538]

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-107403 - Bioprocess Development
M-CIWVT-107406 - Bioprocess Development

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
WT 25/26	2213050	Bioprocess Development	2 SWS	Lecture / 🗣	Grünberger
WT 25/26	2213051	Exercises on 2213050 Bioprocess Development	2 SWS	Practice / 🗣	Grünberger
Exams					
WT 25/26	7222001	Bioprocess Development			Grünberger

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

T 5.17 Module component: Bioprocess Engineering [T-CIWVT-113019]

Coordinators: 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	Term offered	Version
Written examination	5 CP	graded	Each winter term	2

Courses					
WT 25/26	2213010	Bioprocess Engineering	4 SWS	Lecture /	Grünberger, Hubbuch
WT 25/26	2213011	Revision Course Bioprocess Engineering	1 SWS	Practice /	Grünberger
Exams					
ST 2025	722122-VBP-947	Bioprocess Engineering			Grünberger, Hubbuch
WT 25/26	722122-VBP-947	Bioprocess Engineering			Grünberger, Hubbuch

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

Assessment
Written examination with a duration of 120 minutes.

T 5.18 Module component: Biotechnology [T-CIWVT-103669]

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

Type	Credits	Grading	Version
Examination of another type	9 CP	graded	2

Courses					
WT 25/26	2214210	Profile Subject Biotechnology - Management of Scientific Projects	3 SWS	Lecture / Practice (/ 🗣	Perner-Nochta, Grünberger, und Mitarbeitende
WT 25/26	2214211	Profile Subject Biotechnology - Laboratory Work (2214210)	6 SWS	Practical course / 🗣	Perner-Nochta, Grünberger, und Mitarbeitende
WT 25/26	2214212	Profile Subject Biotechnology - Exercises on Management of Scientific Projects (2214210)	1 SWS	Practice / 🗣	Perner-Nochta, und Mitarbeitende
Exams					
WT 25/26	7223002	Biotechnology			Perner-Nochta, Hubbuch

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

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

Prerequisites
None

T 5.19 Module component: Biotechnology [T-CIWVT-103668]

Coordinators: Dr. Nadja Alina Henke
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101143 - Biotechnology

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	2

Courses					
WT 25/26	2214215	Bioanalytics	2 SWS	Lecture / 🗣	Henke, Bleher
Exams					
ST 2025	7214215	Bioanalytics			Henke, Bleher
ST 2025	7223003	Biotechnology			Wörner
WT 25/26	7214215	Bioanalytics			Henke, Bleher

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

Prerequisites
None

T 5.20 Module component: Cell Biology [T-CIWVT-113037]

Coordinators: 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	Term offered	Version
Written examination	2 CP	graded	Each winter term	1

Courses					
WT 25/26	2212113	Biology for Engineers - Cell Biology	2 SWS	Lecture / 🗣	Gottwald
Exams					
ST 2025	7212113-V-ZELL	Cell Biology			Gottwald
WT 25/26	7212113-V-ZELL	BING Cell Biology			Gottwald

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

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

Prerequisites
None

T 5.21 Module component: Chemical Process Engineering [T-CIWVT-101884]

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

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
ST 2025	2220012	Revision Course for the Chemical Process Engineering Exam	2 SWS	Practice /	Wehinger, und Mitarbeitende
WT 25/26	2220010	Chemical Process Engineering	2 SWS	Lecture /	Wehinger
WT 25/26	2220011	Exercises on 2220010 Chemical Process Engineering	2 SWS	Practice /	Wehinger, und Mitarbeitende
WT 25/26	2220012	Revision Course for the Chemical Process Engineering Exam	2 SWS	Practice /	Wehinger, und Mitarbeitende
Exams					
ST 2025	7210101	Chemical Process Engineering			Wehinger
WT 25/26	7210101	Chemical Process Engineering			Wehinger

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.22 Module component: Chemical Reaction Engineering - Exam [T-CIWVT-113695]

Coordinators: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106825 - Chemical Reaction Engineering

Type	Credits	Grading	Version
Oral examination	6 CP	graded	1

Courses					
WT 25/26	2220020	Chemical Process Engineering II	2 SWS	Lecture / 🗣	Wehinger
WT 25/26	2220021	Exercises on 2220020 Chemical Process Engineering II	1 SWS	Practice / 🗣	Wehinger
Exams					
ST 2025	7220021	Chemical Reaction Engineering - Exam			Wehinger

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

T 5.23 Module component: Chemical Reaction Engineering - Project Work [T-CIWVT-113696]

Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106825 - Chemical Reaction Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	1

Courses					
ST 2025	2220023	Chemical Reaction Engineering - Project Work	3 SWS	Project (P / 🗣	Wehinger
WT 25/26	2220022	Chemical Reaction Engineering - Excursion	1 SWS	Excursion (E / 🗣	Wehinger
Exams					
ST 2025	7220023	Chemical Reaction Engineering - Project Work			Wehinger

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

T 5.24 Module component: Circular Economy - Oral Exam [T-CIWVT-112172]

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

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each winter term	1

Courses					
WT 25/26	2232220	Circular Economy	2 SWS	Lecture / 🗣	Stapf
WT 25/26	2232221	Exercises on 2232220 Circular Economy	1 SWS	Practice / 🗣	Stapf
Exams					
ST 2025	7232220	Circular Economy - Oral Exam			Stapf

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

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

Prerequisites
None.

T 5.25 Module component: Circular Economy - Project Work [T-CIWVT-112173]

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

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	1

Courses					
ST 2025	2232222	Circular Economy - Project Work	2 SWS	Project (P / 🗣	Stapf, und Mitarbeitende
Exams					
WT 25/26	7231004	Circular Economy - Project Work			Stapf

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

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

Prerequisites
None.

T 5.26 Module component: Computational Fluid Dynamics [T-CIWVT-106035]

Coordinators: Prof. Dr.-Ing. Hermann Nirschl
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each term	1

Courses					
WT 25/26	2245020	Computational Fluid Dynamics	2 SWS	Lecture /	Nirschl, und Mitarbeitende
WT 25/26	2245021	Exercises for 2245020 Computational Fluid Dynamics	1 SWS	Practice /	Nirschl, und Mitarbeitende
Exams					
ST 2025	7291932	Computational Fluid Dynamics			Nirschl
WT 25/26	7291020	Computational Fluid Dynamics			Nirschl

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

Assessment
Learning control is a written examination lasting 90 minutes.

Prerequisites
None

T 5.27 Module component: Control Engineering and System Dynamics [T-CIWVT-112787]

Coordinators: 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	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2243010	Control Engineering and System Dynamics	2 SWS	Lecture / 🗣	Meurer
ST 2025	2243011	Exercises on Control Engineering and System Dynamics	1 SWS	Practice / 🗣	Meurer, und Mitarbeiter
ST 2025	2243012	Tutorium zu Regelungstechnik und Systemdynamik	1 SWS	Tutorial (/ 🗣	Meurer, und Mitarbeitende
Exams					
ST 2025	7243010	Control Engineering and System Dynamics			Meurer
WT 25/26	7294000	Control Engineering and System Dynamics			Meurer

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

T 5.28 Module component: Data Analysis [T-CIWVT-113039]

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

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2245140	Data Analysis	2 SWS	Lecture / 🗣	Guthausen
Exams					
WT 25/26	7291140	Data Analysis			Guthausen

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

Prerequisites
None

T 5.29 Module component: Design of Machines [T-CIWVT-103641]

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

Type	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

Courses					
ST 2025	2245210	Design of Machines	3 SWS	Lecture / 🗣	Gleiß
Exams					
ST 2025	7291959	Design of Machines			Gleiß

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

Assessment
The Learning control is a completed coursework (ungraded).

Prerequisites
None

T 5.30 Module component: Design of Machines, Exam [T-CIWVT-103642]

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

Type	Credits	Grading	Term offered	Version
Written examination	7 CP	graded	Each term	1

Courses					
ST 2025	2245210	Design of Machines	3 SWS	Lecture / 🗣	Gleiß
Exams					
ST 2025	7291957	Apparatus Design			Gleiß
WT 25/26	7291957	Design of Machines			Gleiß

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

Assessment
Written examination lasting 120 minutes.

Prerequisites
Preparatory

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.31 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / About Knowledge and Science - Self-Registration [T-FORUM-113580]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

In the Advanced Module, students can choose their own individual focus, e.g. sustainable development, data literacy, etc. The focus should be discussed with the module coordinator at the FORUM.

T 5.32 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Public Debates - Self Registration [T-FORUM-113582]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 5.33 Module component: Elective Specialization Supplementary Studies on Science, Technology and Society / Science in Society - Self-Registration [T-FORUM-113581]

Coordinators: Dr. Christine Mielke
Christine Myglas

Organisation: General Studies. Forum Science and Society (FORUM)

Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Assessment
Another type of examination assessment under § 5, section 3 involves a presentation, term paper, or project work within the chosen course.

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
The contents of the basic module are helpful. The basic module should be completed or attended in parallel, but not after the advanced module.
The reading recommendations for primary and specialist literature are determined individually by the respective lecturers according to the subject area and course.

Additional Information
This placeholder can be used for any achievement in the Advanced Unit of the Supplementary Studies.

T 5.34 Module component: Electrochemical Energy Technologies [T-ETIT-111352]

Coordinators: 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	Term offered	Version
Written examination	5 CP	graded	Each winter term	1

Courses					
WT 25/26	2304236	Electrochemical Energy Technologies	2 SWS	Lecture / 🗣	Krewer
WT 25/26	2304237	Exercise for 2304236 Electrochemical Energy Technologies	1 SWS	Practice / 🗣	Pauer
Exams					
ST 2025	7300009	Electrochemical Energy Technologies			Krewer
WT 25/26	7300002	Electrochemical Energy Technologies			Krewer

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

Assessment
Type of Examination: Written exam
Duration of Examination: approx. 120 minutes

Prerequisites
none

T 5.35 Module component: Energy and Environmental Engineering [T-CIWVT-108254]

Coordinators: 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	Version
Written examination	8 CP	graded	1

Courses					
WT 25/26	2231150	Processes for the Production of Chemical Energy Carriers	2 SWS	Lecture / 🗣	Rauch
WT 25/26	2232050	Fundamentals of High Temperature Energy Conversion	2 SWS	Lecture / 🗣	Trimis
Exams					
ST 2025	7230500	Energy and Environmental Engineering			Trimis, Rauch
WT 25/26	7230500-1	Energy and Environmental Engineering			Rauch, Trimis

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.36 Module component: Energy and Environmental Engineering Project Work [T-CIWVT-103527]

Coordinators: 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	Version
Examination of another type	4 CP	graded	1

Courses					
ST 2025	2231151	Projektarbeit im Profilfach Energie- und Umwelttechnik	3 SWS	Project (P / 🗣	Rauch, Trimis, Scheiff
Exams					
WT 25/26	7230501	Energy and Environmental Engineering Project Work			Rauch, Trimis

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

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

Prerequisites
None

T 5.37 Module component: Energy Process Engineering [T-CIWVT-101889]

Coordinators: Dr. Frederik Scheiff
Prof. Dr. Oliver Thomas Stein

Organisation: KIT Department of Chemical and Process Engineering

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

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each term	1

Courses					
WT 25/26	2232110	Energy Process Engineering	2 SWS	Lecture /	Stein, Scheiff
WT 25/26	2232111	Exercises on 2232110 Energy Process Engineering	1 SWS	Practice /	Stein, Scheiff, und Mitarbeitende
Exams					
ST 2025	7232110	Energy Process Engineering			Scheiff, Stein
WT 25/26	7232110	Energy Process Engineering			Stein, Scheiff

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

Assessment
Learning control is a written examination lasting 150 minutes.

Prerequisites
None

T 5.38 Module component: Engineering Mechanics: Dynamics [T-CIWVT-106290]

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

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2241010	Engineering Mechanics: Dynamics	2 SWS	Lecture / 🗣	Klahn
WT 25/26	2241011	Exercises on 2241010 Engineering Mechanics: Dynamics	2 SWS	Practice / 🗣	Klahn, Rentschler
WT 25/26	2241012	Tutorial on 2241010 Engineering Mechanics: Dynamics	1 SWS	Tutorial (/ 🗣	Klahn
Exams					
WT 25/26	7210201	Engineering Mechanics: Dynamics			Klahn

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

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

T 5.39 Module component: Engineering Mechanics: Dynamics, Exam [T-CIWVT-101877]

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

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each term	2

Courses					
WT 25/26	2241010	Engineering Mechanics: Dynamics	2 SWS	Lecture / 🗣	Klahn
WT 25/26	2241011	Exercises on 2241010 Engineering Mechanics: Dynamics	2 SWS	Practice / 🗣	Klahn, Rentschler
WT 25/26	2241012	Tutorial on 2241010 Engineering Mechanics: Dynamics	1 SWS	Tutorial (/ 🗣	Klahn
Exams					
ST 2025	7210200	Engineering Mechanics: Dynamics, Exam			Klahn
WT 25/26	7210200	Engineering Mechanics: Dynamics, Exam			Klahn

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

Assessment
Learming control is a written examination lasting 120 minutes.

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

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.40 Module component: Engineering Mechanics: Statics [T-CIWVT-111054]

Coordinators: Dr.-Ing. Bernhard Hochstein
Dr.-Ing. Claude Oelschlaeger
Prof. Dr. Norbert Willenbacher

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-105846 - Engineering Mechanics: Statics

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each winter term	1

Courses					
WT 25/26	2242210	Engineering Mechanics: Statics	2 SWS	Lecture / 🗣	Willenbacher, Oelschlaeger
WT 25/26	2242211	Exercises on 2242210 Engineering Mechanics: Statics	2 SWS	Practice / 🗣	Oelschlaeger, und Mitarbeitende
Exams					
ST 2025	7290003	Engineering Mechanics: Statics			Oelschlaeger, Hochstein
WT 25/26	7290003	Engineering Mechanics: Statics			Oelschlaeger, Hochstein

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

Prerequisites
None

T 5.41 Module component: Excercises: Membrane Technologies [T-CIWVT-113235]

Coordinators: 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	Term offered	Version
Coursework	1 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2233011	Membrane Technologies in Water Treatment - Excercises	1 SWS	Practice /	Horn, Saravia, und Mitarbeitende
Exams					
ST 2025	7233011	Excercises for Membrane Technologies			Horn, Saravia

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

Assessment
Learning control is a completed coursework: Submission of exercises, membrane design and short presentation (5 minutes, group work).

T 5.42 Module component: Exercises Process Development and Scale-up [T-CIWVT-111005]

Coordinators: 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	Term offered	Version
Coursework	0 CP	pass/fail	Each winter term	1

Exams			
WT 25/26	7200027	Exercises Process Development and Scale-up	Sauer

T 5.43 Module component: Fluiddynamics, Exam [T-CIWVT-101882]

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

Type	Credits	Grading	Version
Written examination	5 CP	graded	1

Courses					
ST 2025	2245010	Fluiddynamics	2 SWS	Lecture / 🗣	Nirschl
ST 2025	2245011	Fluiddynamics - Exercises	2 SWS	Practice / 🗣	Nirschl
Exams					
ST 2025	7291944	Fluiddynamics			Nirschl
WT 25/26	7291944	Fluiddynamics			Nirschl

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

Assessment
Learning control is a written examination lasting 120 minutes.

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.44 Module component: Fluiddynamics, Tutorial [T-CIWVT-101904]

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

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2245010	Fluiddynamics	2 SWS	Lecture / 🗣	Nirschl
ST 2025	2245011	Fluiddynamics - Exercises	2 SWS	Practice / 🗣	Nirschl
Exams					
ST 2025	7291943	Fluiddynamics, Tutorial			Nirschl
WT 25/26	7291943	Fluiddynamics, Tutorial			Nirschl

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

Assessment
Learning control is a completed coursework.

T 5.45 Module component: Food Bioprocess Engineering [T-CIWVT-113021]

Coordinators: Dr.-Ing. Nico Leister
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	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2211020	Food Bioprocess Engineering	2 SWS	Lecture /	Leister
WT 25/26	2211021	Exercises on 2211020 Food Bioprocess Engineering	2 SWS	Practice /	Leister
Exams					
ST 2025	7220006	Food Biotechnology			Leister
WT 25/26	7211020	Food Bioprocess Engineering			Leister
WT 25/26	7220006	Food Biotechnology			Leister

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

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

Prerequisites
Keine.

Workload
180 hours

T 5.46 Module component: Food Bioprocess Engineering Lab [T-CIWVT-113022]

Coordinators: Dr.-Ing. Nico Leister
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106436 - Food Bioprocess Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2211022	Food Bioprocess Engineering - Lab	2 SWS	Practical course / 🗣	Leister

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

Prerequisites
None.

T 5.47 Module component: Food Technology [T-CIWVT-103528]

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

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	3

Courses					
ST 2025	2211043	Exkursion im Profilfach Lebensmitteltechnologie	1 SWS	Excursion (E / 🗣	Leister, und Mitarbeitende
WT 25/26	2211040	Introduction to Food Technology	2 SWS	Lecture / 🗣	Leister, und Mitarbeitende
WT 25/26	2211041	Food Technology - Project Work	1 SWS	Project (P / 🗣	Leister, und Mitarbeitende
Exams					
WT 25/26	7220010	Food Technology			Leister

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

Prerequisites
None.

T 5.48 Module component: Food Technology Project Work [T-CIWVT-103529]

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

Type	Credits	Grading	Version
Examination of another type	7 CP	graded	1

Courses					
ST 2025	2211041	Projektarbeit im Profilfach Lebensmitteltechnologie	4 SWS	Project (P / 🗣)	Leister, und Mitarbeitende
WT 25/26	2211041	Food Technology - Project Work	1 SWS	Project (P / 🗣)	Leister, und Mitarbeitende
Exams					
WT 25/26	7220011	Food Technology Project Work			Leister

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

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

Prerequisites
None

T 5.49 Module component: Formulation and Characterisation of Energy Materials - Exam [T-CIWVT-113478]

Coordinators: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106700 - Formulation and Characterisation of Energy Materials

Type	Credits	Grading	Version
Oral examination	8 CP	graded	1

Courses					
WT 25/26	2242025	Formulation and Characterization of Energy Materials	3 SWS	Lecture / 🗣	Willenbacher, Hochstein, Oelschlaeger
WT 25/26	2242026	Exercises on 2242025 Formulation and Characterization of Energy Materials	1 SWS	Practice / 🗣	Willenbacher, Oelschlaeger, und Mitarbeitende
Exams					
ST 2025	7242025	Formulation and Characterisation of Energy Materials - Exam			Oelschlaeger

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

T 5.50 Module component: Formulation and Characterisation of Energy Materials - Project Work [T-CIWVT-113479]

Coordinators: Dr.-Ing. Claude Oelschlaeger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106700 - Formulation and Characterisation of Energy Materials

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	1

Exams			
ST 2025	7242026	Formulation and Characterisation of Energy Materials - Project Work	Oelschlaeger

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-113478 - Formulation and Characterisation of Energy Materials - Exam must have been passed.

T 5.51 Module component: Fundamentals of Heat and Mass Transfer [T-CIWVT-101883]

Coordinators: Dr.-Ing. Benjamin Dietrich
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	Term offered	Version
Written examination	7 CP	graded	Each term	1

Courses					
ST 2025	2260030	Heat and Mass Transfer	3 SWS	Lecture / 🗣	Wetzel, Dietrich
ST 2025	2260031	Heat and Mass Transfer - Exercises	2 SWS	Practice / 🗣	Wetzel, Dietrich, und Mitarbeitende
Exams					
ST 2025	7280001	Fundamentals of Heat and Mass Transfer			Wetzel, Dietrich
WT 25/26	7280001	Fundamentals of Heat and Mass Transfer			Wetzel, Dietrich

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

Assessment
Learning control is a written examination lasting 180 minutes.

Prerequisites
None

T 5.52 Module component: Fundamentals of Refrigeration, Oral Examination [T-CIWVT-109117]

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

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	3

Courses					
WT 25/26	2250110	Refrigeration A	2 SWS	Lecture / 🗣	Grohmann
WT 25/26	2250111	Refrigeration A - Exercises	1 SWS	Practice / 🗣	Grohmann, und Mitarbeitende
Exams					
ST 2025	7250110	Fundamentals of Refrigeration, oral examination			Grohmann
WT 25/26	7250110	Fundamentals of Refrigeration, oral examination			Grohmann

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

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

Prerequisites
Projects Work

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.53 Module component: Fundamentals of Refrigeration, Project Work [T-CIWVT-109118]

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

Type	Credits	Grading	Version
Examination of another type	6 CP	graded	1

Courses					
ST 2025	2250112	Fundamentals of Refrigeration - Project Work	2 SWS	Practice / 🗣	Grohmann
Exams					
ST 2025	7250112	Fundamentals of Refrigeration, Project Work			Grohmann
WT 25/26	7250112	Fundamentals of Refrigeration, Project Work			Grohmann

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

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

Prerequisites
None

T 5.54 Module component: General Chemistry and Chemistry of Aqueous Solutions [T-CIWVT-101892]

Coordinators: 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	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2233050	General Chemistry and Chemistry in Aqueous Solutions	3 SWS	Lecture / 🗣	Horn
WT 25/26	2233051	Excercises on 2233050 General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Practice / 🗣	Horn, Guthausen, Wagner
WT 25/26	2233052	Tutorial A to 2233050 General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Tutorial (/ 🗣	Guthausen, Wagner
WT 25/26	2233053	Tutorial B to 2233050 General Chemistry and Chemistry in Aqueous Solutions	2 SWS	Tutorial (/ 🗣	Guthausen, Wagner
Exams					
WT 25/26	7232667	General Chemistry and Chemistry of Aqueous Solutions			Horn, Guthausen
WT 25/26	7232668	General Chemistry and Chemistry of Aqueous Solutions			Horn, Guthausen

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

Assessment
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

Workload
180 hours

T 5.55 Module component: Genetics [T-CIWVT-111063]

Coordinators: 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	Term offered	Version
Written examination	2 CP	graded	Each winter term	1

Courses					
WT 25/26	2212111	Biology for Engineers - Genetics	2 SWS	Lecture / 🗣	Neumann
Exams					
ST 2025	7212114-V-GEN	Genetics			Neumann
WT 25/26	7212114-V-GEN	Genetics			Neumann

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

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

Prerequisites
None

T 5.56 Module component: Industrial Organic Chemistry [T-CIWVT-101890]

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

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each term	1

Courses					
WT 25/26	2231140	Industrial Organic Chemistry	3 SWS	Lecture / 🗣	Rauch
WT 25/26	2231141	Exercises on 2231140 Industrial Organic Chemistry	1 SWS	Practice / 🗣	Rauch
Exams					
ST 2025	7223703	Industrial Organic Chemistry			Rauch
WT 25/26	7223703	Industrial Organic Chemistry			Rauch

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.57 Module component: Intensification of Bioprocesses - Written Exam [T-CIWVT-112998]

Coordinators: 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	Version
Written examination	6 CP	graded	1

Courses					
ST 2025	2212050	Intensification of Bioprocesses	2 SWS	Lecture / 🗣	Holtmann
ST 2025	2212051	Intensification of Bioprocesses - Exercises	2 SWS	Practice / 🗣	Holtmann, und Mitarbeitende
Exams					
ST 2025	7212050-WP-IBP	Intensification of Bioprocesses - Written Exam			Holtmann
WT 25/26	7212050-WP-IBP	Intensification of Bioprocesses - Written Exam			Holtmann

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

T 5.58 Module component: Intensivication of Bioprocesses - Lab [T-CIWVT-112999]

Coordinators: 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	Version
Examination of another type	3 CP	graded	1

Courses					
ST 2025	2212052	Intensification of Bioprocesses - Lab	2 SWS	Practical course / 🗣	Neumann, Holtmann, und Mitarbeitende
Exams					
ST 2025	7212052-P-IBP	Intensification of Bioprocesses - Lab			Neumann

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

T 5.59 Module component: Internship [T-CIWVT-106036]

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

Type	Credits	Grading	Version
Coursework	14 CP	pass/fail	1

Exams			
WT 25/26	7200000	Internship	Bajohr

T 5.60 Module component: Introduction into Bioengineering [T-CIWVT-113018]

Coordinators: 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: M-CIWVT-106433 - Introduction into Bioengineering

Type	Credits	Grading	Version
Written examination	5 CP	graded	1

Courses					
ST 2025	2210010	Introduction into Bioengineering	4 SWS	Lecture / 🗣	Grünberger, Holtmann, Hubbuch, van der Schaaf
Exams					
ST 2025	7210010	Introduction into Bioengineering			Grünberger, Holtmann, Hubbuch, van der Schaaf
WT 25/26	7210010	Introduction into Bioengineering			Grünberger, Holtmann, Hubbuch, van der Schaaf

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

Prerequisites
None

T 5.61 Module component: Introduction to Thin Film Technology - Exercises and Lab [T-CIWVT-114693]

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-107495 - Introduction to Thin Film Technology

Type	Credits	Grading	Version
Examination of another type	6 CP	graded	1

Courses					
WT 25/26	2260240	Introduction to Thin Film Technology	2 SWS	Lecture / 🗣	Scharfer, Schabel
WT 25/26	2260241	Selected Chapters of Thin Film Technology	2 SWS	Seminar / 🗣	Scharfer, Schabel
WT 25/26	2260242	Thin Film Technology - Lab	2 SWS	Practical course / 🗣	Scharfer, Schabel

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

T 5.62 Module component: Introduction to Thin Film Technology - Project Work [T-CIWVT-114692]

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

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-107495 - Introduction to Thin Film Technology

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	1

Courses					
WT 25/26	2260242	Thin Film Technology - Lab	2 SWS	Practical course / 🗣	Scharfer, Schabel

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

Prerequisites
None

T 5.63 Module component: Kinetics and Catalysis [T-CIWVT-106032]

Coordinators: Prof. Dr.-Ing. Gregor Wehinger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each term	1

Courses					
ST 2025	2220030	Kinetics and Catalysis	2 SWS	Lecture / 🗣	Wehinger
ST 2025	2220031	Kinetics and Catalysis - Exercises	1 SWS	Practice / 🗣	Wehinger, und Mitarbeitende
Exams					
ST 2025	7210102	Kinetics and Catalysis			Wehinger
WT 25/26	7210102	Kinetics and Catalysis			Wehinger

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

Assessment
Learning control is a written examination lasting 60 minutes.

Prerequisites
None

T 5.64 Module component: Laboratory Course: Electrochemical Energy Technologies [T-ETIT-111376]

Coordinators: Dr. Philipp Röse
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105703 - Laboratory Course: Electrochemical Energy Technologies

Type	Credits	Grading	Term offered	Version
Examination of another type	5 CP	graded	Each summer term	1

Courses					
ST 2025	2304303	Laboratory Electrochemical Energy Technologies	3 SWS	Practical course / 🗣	Röse
Exams					
ST 2025	7300022	Laboratory course: Electrochemical Energy Technologies			Röse

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

Assessment
Success control takes place in the form of other types of examination. It consists of four experiments and written reports are assessed in each case. The module grade is based on the overall impression.

The successfully completed exoeriments together form an examination unit. If you fail, you have to repeat the internship in its entirety.

Prerequisites

- The prerequisite for admission to the module is that the students have successfully passed the module examination of „M-ETIT-105690 – Electrochemical Energy Technologies“. Participation in the safety briefing is mandatory.
- Participation in the safety instruction is required in the same examination period as the internship and must be completed again if the internship is repeated.

T 5.65 Module component: Laboratory Work: Bioprocess Development [T-CIWVT-114542]

Coordinators: Prof. Dr.-Ing. Alexander Grünberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-107406 - Bioprocess Development

Type	Credits	Grading	Version
Examination of another type	3 CP	graded	1

Courses					
WT 25/26	2213052	Bioprocess Development - Lab	2 SWS	Practical course / 🗣	Grünberger, und Mitarbeitende

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

T 5.66 Module component: Laboratory Work: Downstream Processing [T-CIWVT-113024]

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

Type	Credits	Grading	Version
Examination of another type	3 CP	graded	1

Courses					
ST 2025	2214060	Laboratory Work: Downstream Processing	2 SWS	Practical course / 🗣	Hubbuch, und Mitarbeiter
Exams					
ST 2025	7223004	Laboratory Work: Downstream Processing			Hubbuch

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

Assessment
Learning control is an examination of another type.

Prerequisites
None

T 5.67 Module component: Laboratory Work: General Chemistry [T-CIWVT-113015]

Coordinators: Prof. Dr. Harald Horn
Stephanie West
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-106427 - Basic Practical Course in Natural Sciences

Type	Credits	Grading	Term offered	Version
Coursework (practical)	2 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2200350	Safety Instruction and Introduction to Practical Courses 1st Semester BIW und CIW	1 SWS	Lecture / 🗣	Dietrich, Sinanis, West, und Mitarbeitende
WT 25/26	2233054	Basic Practical Course in Natural Sciences - Part I: General Chemistry	2 SWS	Practical course / 🗣	Horn, West
Exams					
WT 25/26	7233054	Laboratory Work: General Chemistry			Horn

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

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

Modeled Prerequisites
The following conditions have to be fulfilled:

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

Workload
120 hours

T 5.68 Module component: Laboratory Work: Microbiology for Engineers [T-CIWVT-113014]

Coordinators: 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	Term offered	Version
Coursework (practical)	2 CP	pass/fail	Each winter term	1

Courses					
WT 25/26	2212150	Basic Practical Course in Natural Sciences - Part II: Microbiology	2 SWS	Practical course / 🗣	Neumann
Exams					
WT 25/26	7212150-GP2-MIBI	Laboratory Work: Microbiology for Engineers			Neumann

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

Assessment
Completed Courswork (ungraded): Practical course in microbiology lasting 1 week.
The practical course is passed under the following conditions:
a) Passing the introductory colloquium
b) Participation in all experiments
c) Passing the practical course protocols

Prerequisites

- The written examination General Chemistry and Chemistry in Aqueous Solutions must be passed.
- It is recommended to complete the practical part of General Chemistry first, but this is not a prerequisite.

Modeled Prerequisites
The following conditions have to be fulfilled:

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

T 5.69 Module component: Lecture Series Supplementary Studies on Science, Technology and Society - Self Registration [T-FORUM-113578]

Coordinators: Dr. Christine Mielke
Christine Myglas
Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	2 CP	pass/fail	Each summer term	1 semesters	1

Assessment
Active participation, learning protocols, if applicable.

Prerequisites
None

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium

Recommendations
It is recommended that you complete the lecture series "Science in Society" before attending events in the advanced module and in parallel with attending the basic seminar.
If it is not possible to attend the lecture series and the basic seminar in the same semester, the lecture series can also be attended after attending the basic seminar.
However, attending events in the advanced module before attending the lecture series should be avoided.

Additional Information
The basic module consists of the lecture series "Science in Society" and the basic seminar. The lecture series is only offered during the summer semester.
The basic seminar can be attended in the summer or winter semester.

T 5.70 Module component: Mathematical Modeling for Biochemical Engineering [T-MATH-113040]

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

Type	Credits	Grading	Version
Examination of another type	4 CP	graded	1

Exams			
ST 2025	7700145	Mathematical Modeling for Biochemical Engineering	Thäter

T 5.71 Module component: Mechanical Processing [T-CIWVT-101886]

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

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each term	1

Courses					
WT 25/26	2244010	Mechanical Processing	2 SWS	Lecture / 🗣	Dittler
WT 25/26	2244011	Exercises on 2244010 Mechanical Processing	2 SWS	Practice / 🗣	Dittler, und Mitarbeitende
Exams					
ST 2025	7244010	Mechanical Processing			Dittler
WT 25/26	7244010	Mechanical Processing			Dittler

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.72 Module component: Mechanical Separation Technology Exam [T-CIWVT-103448]

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

Type	Credits	Grading	Term offered	Version
Oral examination	8 CP	graded	Each summer term	1

Courses					
WT 25/26	2245230	Mechanical Separation Technology	3 SWS	Lecture / 🗣	Gleiß
WT 25/26	2245231	Exercises for 2245230 Mechanical Separation Technology	1 SWS	Practice / 🗣	Gleiß
Exams					
WT 25/26	7291231	Mechanical Separation Technology Exam			Gleiß

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

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

Prerequisites
None

T 5.73 Module component: Mechanical Separation Technology Project Work [T-CIWVT-103452]

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

Type	Credits	Grading	Version
Examination of another type	4 CP	graded	1

Courses					
ST 2025	2245232	Project Work for Profile Subject Mechanical Separation Techniques	1 SWS	Practice / 🗣	Gleiß, und Mitarbeitende
Exams					
WT 25/26	7291300	Mechanical Separation Technology Project Work			Gleiß

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

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

Prerequisites
none

T 5.74 Module component: Medical Imaging Technology [T-ETIT-113625]

Coordinators: Prof. Dr.-Ing. Maria Francesca Spadea
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106778 - Medical Imaging Technology

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2305263	Medical Imaging Technology	4 SWS	Lecture / Practice (/	Spadea, Arndt
Exams					
ST 2025	7305260	Medical Imaging Technology			Spadea, Arndt
WT 25/26	7305260	Medical Imaging Technology			Spadea

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

Assessment
The examination takes place in form of a written examination lasting 120 minutes. The course grade is the grade of the written exam.

Prerequisites
none

T 5.75 Module component: Membrane Technologies in Water Treatment [T-CIWVT-113236]

Coordinators: 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	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2233010	Membrane Technologies in Water Treatment	2 SWS	Lecture / 🗣	Horn, Saravia
ST 2025	2233011	Membrane Technologies in Water Treatment - Excercises	1 SWS	Practice / 🧩	Horn, Saravia, und Mitarbeitende
Exams					
ST 2025	7233010	Membrane Technologies in Water Treatment			Horn, Saravia
WT 25/26	7232605	Membrane Technologies in Water Treatment			Horn, Saravia

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

Assessment
Learning control is an written examination lasting 90 minutes.

Prerequisites
Prerequisite: Submission of exercises, membrane design and short presentation (5 minutes, group work).

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-113235 - Excercises: Membrane Technologies must have been passed.

T 5.76 Module component: Micro Process Engineering [T-CIWVT-103667]

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

Type	Credits	Grading	Version
Examination of another type	5 CP	graded	1

Courses					
ST 2025	2220221	Micro Process Engineering - Project Work	2 SWS	Practice / 🗣	Dittmeyer, Pfeifer, und Mitarbeitende
Exams					
ST 2025	7220221	Micro Process Engineering			Pfeifer

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

Assessment
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 5.77 Module component: Micro Process Engineering [T-CIWVT-103666]

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

Type	Credits	Grading	Term offered	Version
Oral examination	7 CP	graded	Each summer term	1

Courses					
WT 25/26	2220220	Design of Micro Reactors	3 SWS	Lecture / Practice (/	Pfeifer
Exams					
ST 2025	7220222	Micro Process Engineering			Pfeifer

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

Assessment
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 5.78 Module component: Microbiology [T-CIWVT-113038]

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

Type	Credits	Grading	Term offered	Version
Written examination	2,5 CP	graded	Each summer term	1

Courses					
ST 2025	2212112	Biology for Engineers - Microbiology	2 SWS	Lecture / 🗣	Neumann
Exams					
ST 2025	7212112-V-MIBI	Microbiology			Neumann
WT 25/26	7212112-V-MIBI	BING Microbiology			Neumann

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

Assessment
Written Examination with a duration of 90 minutes.

T 5.79 Module component: Organic Chemistry for Engineers [T-CHEMBIO-101865]

Coordinators: Prof. Dr. Michael Meier
Organisation: KIT Department of Chemistry and Biosciences
Part of: M-CHEMBIO-101115 - Organic Chemistry for Engineers

Type	Credits	Grading	Version
Written examination	5 CP	graded	2

Courses					
ST 2025	5142	Organische Chemie für CIW/VT und BIW	2 SWS	Lecture / 🗣	Levkin
ST 2025	5143	Übungen zu Organische Chemie für CIW/VT und BIW	2 SWS	Practice / 🗣	Levkin
Exams					
ST 2025	7100017	Organic Chemistry for CIW, BIW, VT und MWT			Levkin, Podlech
ST 2025	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 5.80 Module component: Particle Technology Exam [T-CIWVT-106028]

Coordinators: Prof. Dr.-Ing. Achim Dittler
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
ST 2025	2244030	Particle Technology	2 SWS	Lecture / 🗣	Dittler
ST 2025	2244031	Particle Technology - Exercises	1 SWS	Practice / 🗣	Dittler, und Mitarbeitende
Exams					
ST 2025	7244030	Particle Technology Exam			Dittler
WT 25/26	7244030	Particle Technology Exam			Dittler

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

Assessment
Learning control is a written examination lasting 120 minutes.

Prerequisites
None

T 5.81 Module component: Physiology and Anatomy for Biomedical Engineering [T-ETIT-111815]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105874 - Physiology and Anatomy for Biomedical Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
ST 2025	2305282	Physiology and Anatomy for Engineers II	2 SWS	Lecture / 🗣	Nahm
WT 25/26	2305281	Physiology and Anatomy for Engineers I	2 SWS	Lecture / 🗣	Nahm
Exams					
ST 2025	7305283	Physiology and Anatomy for Biomedical Engineering			Nahm, Weiß, Krames
WT 25/26	7305283	Physiology and Anatomy for Biomedical Engineering			Nahm

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

Assessment
The exmaniation is carried out in the form of a written test of 120 minutes.

The examination includes the contents of Physiologie und Anatomie I (offered every winter term) and Physiologie und Anatomie II (offered every summer term).

Prerequisites
The courses "T-ETIT-101932 - Physiologie und Anatomie I" und "T-ETIT-101933 - Physiologie und Anatomie II" must not been started.

Additional Information
Winter/summer term:

WT: Physiologie und Anatomie I
ST: Physiologie und Anatomie II

T 5.82 Module component: Process and Plant Design in Biotechnology - Seminar [T-CIWVT-114498]

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

Type	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each summer term	1

Courses					
WT 25/26	2212020	Process and Plant Design in Biotechnology	2 SWS	Lecture / 🗣	Holtmann
WT 25/26	2212021	Exercises on 2212020 Process and Plant Design in Biotechnology	1 SWS	Seminar / 🗣	Holtmann
Exams					
WT 25/26	7212021-Ü-PAD	Process and Plant Design in Biotechnology - Seminar			Holtmann

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

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

Prerequisites
None

T 5.83 Module component: Process and Plant Design in Biotechnology - Written Exam [T-CIWVT-114499]

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

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2212020	Process and Plant Design in Biotechnology	2 SWS	Lecture / 🗣	Holtmann
WT 25/26	2212021	Exercises on 2212020 Process and Plant Design in Biotechnology	1 SWS	Seminar / 🗣	Holtmann
Exams					
WT 25/26	7212020-V-PAD	Process and Plant Design in Biotechnology			Holtmann

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

Assessment
Learning control is a written examination lasting 90 minutes.

Prerequisites
Seminar

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-114498 - Process and Plant Design in Biotechnology - Seminar must have been passed.

Recommendations
Knowledge in biochemistry, genetics, cell biology, microbiology and bioprocess engineering is required.

T 5.84 Module component: Process Development and Scale-up [T-CIWVT-103530]

Coordinators: 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	Term offered	Version
Oral examination	8 CP	graded	Each summer term	2

Courses					
WT 25/26	2231310	Process Development and Scale-Up	2 SWS	Lecture / 🗣	Sauer
WT 25/26	2231311	Exercises on 2231310 Process Development and Scale-Up	2 SWS	Practice / 🗣	Sauer, und Mitarbeitende
Exams					
ST 2025	7231310	Process Development and Scale-up			Sauer

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-111005 - Exercises Process Development and Scale-up must have been passed.

T 5.85 Module component: Process Development and Scale-up Project Work [T-CIWVT-103556]

Coordinators: 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	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	1

Courses					
ST 2025	2231312	Project Work in the Profile Course "Process Development and Scale-up"	2 SWS	Project (P / 🗣	Sauer, und Mitarbeitende
ST 2025	2231313	Presentation Profile Course "Process Development and Scale-up"		Others (sons / 🗣	Sauer
Exams					
ST 2025	7231312	Process Development and Scale-up Project Work			Sauer

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

Assessment
Learning control is an examination of another type: Project work.

Prerequisites
None.

T 5.86 Module component: Programming and Numeric Simulation [T-CIWVT-113025]

Coordinators: Dr.-Ing. Pascal Jerono
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	Version
Coursework	1 CP	pass/fail	1

Courses					
ST 2025	2243080	Programming and Numeric Simulation Using MATLAB	2 SWS	Lecture / 🗣	Meurer, Jerono
Exams					
ST 2025	7243080	Programming and Numeric Simulation - Exam			Meurer, Jerono
WT 25/26	7243080	Programming and Numeric Simulation - Exam			Meurer, Jerono

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

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-113074 - Programming and Numeric Simulation Using MATLAB - Ecercises must have been passed.

T 5.87 Module component: Programming and Numeric Simulation Using MATLAB - Ecercises [T-CIWVT-113074]

Coordinators: 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	Version
Coursework	2 CP	pass/fail	1

Courses					
ST 2025	2243080	Programming and Numeric Simulation Using MATLAB	2 SWS	Lecture / 🗣	Meurer, Jerono
Exams					
ST 2025	7243081	Programming and Numeric Simulation - Examination Prerequisite			Meurer, Jerono

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

T 5.88 Module component: Registration for Certificate Issuance - Supplementary Studies on Science, Technology and Society [T-FORUM-113587]

Coordinators: Dr. Christine Mielke
Christine Myglas
Organisation: General Studies. Forum Science and Society (FORUM)
Part of: M-FORUM-106753 - Supplementary Studies on Science, Technology and Society

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each term	1

Prerequisites
In order to register, it is mandatory that the basic module and the advanced module have been completed and that the grades for the partial performances in the advanced module are available.

Registration as a partial achievement means the issue of a certificate.

T 5.89 Module component: Scientific Writing with LaTeX [T-HOC-113121]

Coordinators: Andreas Hirsch-Weber
Organisation:
Part of: M-HOC-106502 - Scientific Writing with LaTeX

Type	Credits	Grading	Version
Coursework	2 CP	pass/fail	1

Courses					
ST 2025	9004902	Scientific Writing with LaTeX		Block / 🏵	Hirsch-Weber, Winandi, Sielaff
WT 25/26	9004902	Scientific Writing with LaTeX		Block / 🏵	Hirsch-Weber, Winandi, Sielaff
Exams					
WT 25/26	9900017	Scientific Writing with LaTeX			

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

T 5.90 Module component: Thermal Process Engineering [T-CIWVT-101885]

Coordinators: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101134 - Thermal Process Engineering

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
WT 25/26	2260110	Thermal Process Engineering	2 SWS	Lecture /	Zeiner
WT 25/26	2260111	Exercises for 2260110 Thermal Process Engineering	2 SWS	Practice /	Zeiner, und Mitarbeitende
Exams					
ST 2025	7280002	Thermal Process Engineering			Zeiner
WT 25/26	7280002	Thermal Process Engineering			Zeiner

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

T 5.91 Module component: Thermal Process Engineering II [T-CIWVT-114107]

Coordinators: Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading	Version
Written examination	6 CP	graded	1

Courses					
ST 2025	2260150	Thermal Process Engineering II	2 SWS	Lecture / 🗣	Zeiner
ST 2025	2260151	Thermal Process Engineering - Exercises	2 SWS	Practice / 🗣	Zeiner, und Mitarbeitende
Exams					
ST 2025	7260150	Thermal Process Engineering II			Zeiner
WT 25/26	7260150	Thermal Process Engineering II			Zeiner

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

Prerequisites
None.

T 5.92 Module component: Thermodynamics for Bioengineering [T-CIWVT-114497]

Coordinators: Prof. Dr. Sabine Enders
Prof. Dr.-Ing. Tim Zeiner
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101991 - Single Results

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	1

Prerequisites
None.

Recommendations
Thermodynamics II.

T 5.93 Module component: Thermodynamics I, Exam [T-CIWVT-101879]

Coordinators: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101129 - Thermodynamics I

Type	Credits	Grading	Version
Written examination	7 CP	graded	1

Courses					
WT 25/26	2250010	Thermodynamics I	3 SWS	Lecture / 🗣	Enders
WT 25/26	2250011	Thermodynamics I - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeitende
WT 25/26	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeitende
Exams					
ST 2025	7250010	Thermodynamics I Exam			Enders
WT 25/26	7250010	Thermodynamics I Exam			Enders

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

Assessment
Learning control is a written examination lastin 120 minutes.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-101878 - Thermodynamics I, Tutorial must have been passed.

T 5.94 Module component: Thermodynamics I, Tutorial [T-CIWVT-101878]

Coordinators: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101129 - Thermodynamics I

Type	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

Courses					
WT 25/26	2250010	Thermodynamics I	3 SWS	Lecture / 🗣	Enders
WT 25/26	2250011	Thermodynamics I - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeitende
WT 25/26	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeitende
Exams					
WT 25/26	7250011	Thermodynamics I, Tutorial			Enders

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

Prerequisites
None

T 5.95 Module component: Thermodynamics II, Exam [T-CIWVT-101881]

Coordinators: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101130 - Thermodynamics II

Type	Credits	Grading	Version
Written examination	7 CP	graded	1

Courses					
ST 2025	2250020	Thermodynamics II	3 SWS	Lecture / 🗣	Enders
ST 2025	2250021	Thermodynamics II - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeitende
ST 2025	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeitende
Exams					
ST 2025	7250020	Thermodynamics II, Exam			Enders
WT 25/26	7250020	Thermodynamics II, Exam			Enders

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

Assessment
Learning control is a written examination lastin 120 minutes.

Prerequisites
Precondition for participation: 2 of 3 compulsory exercises have to be approved

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-CIWVT-101880 - Thermodynamics II, Tutorial must have been passed.

T 5.96 Module component: Thermodynamics II, Tutorial [T-CIWVT-101880]

Coordinators: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101130 - Thermodynamics II

Type	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

Courses					
ST 2025	2250020	Thermodynamics II	3 SWS	Lecture / 🗣	Enders
ST 2025	2250021	Thermodynamics II - Exercises	2 SWS	Practice / 🗣	Enders, und Mitarbeitende
ST 2025	2250022	Tutorial Thermodynamics I and II	2 SWS	Tutorial (/ 🗣	Enders, und Mitarbeitende
Exams					
ST 2025	7250021	Thermodynamics II, Tutorial			Enders

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

Assessment
The learning control is a completed coursework; prerequisite for the written exam.

Prerequisites
None

T 5.97 Module component: Tutorial Advanced Mathematics I [T-MATH-100525]

Coordinators: 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	Term offered	Version
Coursework (written)	0 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	0131100	Übungen zu 0131000	2 SWS	Practice	Arens
WT 25/26	0131300	Übungen zu 0131200	2 SWS	Practice	Arens
Exams					
ST 2025	7700166	Tutorial Advanced Mathematics I			Arens
WT 25/26	6700005	Problem Class for Advanced Mathematics I			Arens, Griesmaier, Hettlich

Assessment
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 5.98 Module component: Tutorial Advanced Mathematics II [T-MATH-100526]

Coordinators: 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	Term offered	Version
Coursework (written)	0 CP	pass/fail	Each summer term	3

Courses					
ST 2025	0180900	Übungen zu 0180800	2 SWS	Practice	Arens
ST 2025	0181100	Übungen zu 0181000	2 SWS	Practice	Arens
Exams					
ST 2025	7700024	Problem Class for Advanced Mathematics II			Hettlich, Arens, Griesmaier

Assessment
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.

T 5.99 Module component: Tutorial Advanced Mathematics III [T-MATH-100527]

Coordinators: 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	Term offered	Version
Coursework (written)	0 CP	pass/fail	Each winter term	2

Courses					
WT 25/26	0131500	Übungen zu 0131400	2 SWS	Practice	Hettlich
Exams					
WT 25/26	6700006	Tutorial Advanced Mathematics III			Arens, Griesmaier, Hettlich

Assessment
Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

Prerequisites
None.